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BSR 4175

Laser Geodynamic Satellite Thermal/Optical/Vibrational Analyses and Testing

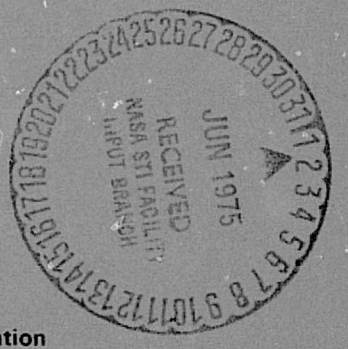
Final Report Addendum

Volume II
Technical Report

Book 2

DR No. MA-04
DPD No. 296
Contract NAS 8-30658

January 1975



Prepared for:

George C. Marshall Space Flight Center
National Aeronautics and Space Administration
Marshall Space Flight Center, Alabama 35812

Bendix Aerospace Systems Division

Ann Arbor, Michigan

Laser Geodynamic Satellite Thermal/Optical/Vibrational Analyses and Testing

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VOLUME II

Book 2

This Book 2 of Volume II contains only Appendix E.

APPENDIX E

31 JANUARY 1975

LASER GEODYNAMIC SATELLITE (LAGEOS)

DIHEDRAL ANGLE IMPROVEMENT PROGRAM

Prepared for

Bendix Aerospace Division

3300 Plymouth Road

Ann Arbor, Michigan 48107

In response to Contract No. T2997

Amendment No. 4

Itek

Optical Systems Division

ITEK CORPORATION • 10 MAGUIRE ROAD • LEXINGTON, MASSACHUSETTS 02173

FOREWARD

This final report, prepared by Itek Corporation, Lexington, Massachusetts under Purchase Order No. T-2997, amendment No. 4 to Bendix Aerospace Systems Division, Ann Arbor, Michigan covers work performed from 27 September 1974 to 31 January 1975 under the direction of Bendix Aerospace. The Bendix project manager was Mr. John M. Brueger.

The following Itek personnel were the primary contributors to the work summarized in the report:

Project Manager	M. Kahan
Chief Engineer	M. Rimmer
Lead Optical Engineer	R. Byrd
Optical Analysis	C. King

The report documents the evaluations performed to recommend the specific LAGEOS cube-corner dihedral angle which might further optimize the far field pattern on the earth which results from satellite laser ranging. This study should be taken together with Book 2 of Volume II of DR No. MA-04 (DPD No. 296, Contract NAS-8-30658, October 1974) which showed that the planned hardware may have been configured with too large a dihedral angle and which also noted an apparent paradox between measured and predicted far field characteristics (differences are shown in this report to be due to polarization and diffraction effects).

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ABSTRACT/SUMMARY

The purpose of this Itek Corporation LAGEOS effort was to provide a more detailed comparison of the differences between various theoretical and experimental results relative to the quality of a retro-reflected laser signal's far field diffraction pattern. The resultant recommendations helped to further optimize the cubes relative to the specific cube geometries and configurations of interest. They were one of several inputs used by Bendix Aerospace, NASA and SAO in configuring a Laser Geodynamic Satellite to accurately establish the physical motions and distortions of the solid earth. The overall effort was conducted as a part of the Earth and Ocean Physics Application Program (EOPAP). Interested readers are referred to Book 2 Volume II of DR No. MA-04 (DPD No. 296, Contract NAS 8-30658, October 1974) for additional background material relative to this study.

The main tasks performed by Itek involved an interferometric evaluation of several cubes, a prediction of their dihedral angles, a comparison of these predictions with independent measurements, a prediction and comparison of far field performance, recommendations as to revised dihedral angles and a subsequent analysis of cubes which were reworked to confirm the recommendations. A tolerance study and theoretical evaluation of several cubes was also performed to aid in understanding the results. The far field characteristics evaluated included polarization effects and treated both intensity distribution and encircled energy data. The energy in the 13.2 - 16.9 arc-sec annular region was tabulated as an indicator of performance sensitivity as this was roughly the region where comparable Bendix Aerospace test data was taken.

The results are provided rather succintly in Appendix D in viewgraph form. They show the average dihedral angle of an original set of test cubes to have been 1.8 arc-sec with an average far field annulus diameter of 18 arc-sec. Since the peak energy in the 13.2 - 16.9 arc-sec annulus was found to occur for a 1.35 arc-sec cube, and since cube tolerances were shown to increase the annulus diameter slightly, a nominal dihedral angle of 1.25 arc-sec was recommended (measured data also showed a tendency to a high annulus diameter and a low percent of the incident energy in the 13.2 - 16.9 arc-sec region). Tests and evaluations were subsequently performed on a set of reworked cubes of smaller dihedral angle to confirm these recommendations. Although the interferometrically predicted dihedral angles on the reworked cubes were about 0.5 arc-sec smaller than desired/mechanically measured, and the far field measurements had a higher percent of the

incident energy in the annulus than predicted (and a larger centroid diameter), the results tended to confirm the 1.25 $\pm$ 0.5 arc-sec dihedral angle recommendation.

It was noted that differences between measured and predicted far field results could have been caused by a reduced annulus diameter. Also, the far field annulus was shown to be larger than geometrical predictions due to diffraction/polarization effects. The mechanically measured angles for the reworked cubes had a constant offset from the interferometrically predicted dihedral angles. For this reason it was suggested that production cubes be checked interferometrically to verify their dihedral angles.

Agreement between the Itek and SAO models for the far field intensity distribution was obtained during the course of the study which lends added confidence to the conclusions reached, although the practical results of the changes were quite small (e.g. a revision of the Itek model changed the total energy in the 13.2 - 16.9 arc-sec annulus by less than 0.1% of the total energy).

Future work suggested includes a cross-check by Itek of the production cubes. Also, an additional treatment of field angle/polarization inputs may be desirable. Eventually, an evaluation of performance at shorter wavelengths and of different cube types/cube corner arrays might be of interest, as might a further comparison of predicted vs. measured far field characteristics where some differences still exist.

Background

This report is submitted by Itek Corporation's Optical System Division in accordance with the requirement of contract T2997 ammendment No. 4, to furnish a detailed evaluation of potential LAGEOS solid fused silica cube-corner retro-reflectors. Readers interested in supplemental detail should refer to Book 2 of Volume II of DR No. MA-04, previously referenced for added background material. This earlier document provides information on the procedures, polarization effects, the computer output formats' meanings and the detailed modelling assumptions which have been used during the study.

The main tasks reported on by Itek in the earlier report were the modelling, over field angle, of an individual suprasil cube-corner having potential manufacturing variations (e.g. surface quality and angular anomalies) and environmental loadings. The far field characteristics treated included both intensity patterns and encircled energy data. Thus, the energy in the 32 - 42 μ radian annular region was tabulated as an indicator of performance sensitivity as this was roughly the region where comparable Bendix Aerospace test data was taken.

The results of this earlier study showed that given no reflection or absorption losses, a 1.5 arc-sec cube returned 21.6% of the incident energy on-axis and 10.8% at -15° off-axis in the annulus of interest. The retroreflector's encircled energy data was relatively insensitive to irregular dihedral angle errors and surface quality effects. However, up to 6.8% changes in annular energy (e.g. 22% to 14%) were noted when all dihedral angles were simultaneously offset in the same direction by 0.5 arc-sec. The 3-D temperature profiles analyzed changed the annular return only about 1%. Finally, the axial thermal gradients were found to compensate the radial gradients - the individual gradient types having fairly high sensitivity. In no case which was analyzed to simulate actual cube performance (as opposed to pure sensitivity determinations) did the annular return drop to 50% of that of the nominal cube - the criterion supplied us to assess degradation severity.

Future work suggested included a more detailed comparison of the differences between various theoretical and experimental results for the specific cube geometries and test configurations of interest. It was thought that this might help to further optimize the cubes. The current report is a result, in part, of this earlier (Phase I) recommendation.

Introduction

The purpose of this Itek Corporation Contract was to resolve contradictions between experimental test results and analytical predictions and to recommend an optimum cube dihedral angle for manufacturing. The work performed at Itek consisted of three main tasks.

1. A tolerance analysis of perfect cubes with different dihedral angles, and of cubes with dihedral angle errors.

2. Analysis of six existing cube corners to predict cube dihedral angles and resultant far field patterns.

3. Analysis of three reworked cubes to predict cube dihedral angles and far field patterns.

Each portion of this study is presented in the body of this report and a recommendation of a dihedral angle is made so as to optimize performance.

Tolerance Study

The customer requirements dictate that the maximum energy be located in a 13.2 - 16.9 arc-seconds annulus diameter. According to geometrical optics a perfect cube with equal dihedral angles of 1.5 arc-seconds* will produce the maximum energy in this annulus. This tolerance study includes the effects of diffraction and polarization in computing the energy in the 13.2 - 16.9 arc seconds annulus.

Under Phase I of the contract perfect cubes with dihedral angles of 1.5 and 2.1 arc-seconds were analyzed. In order to find the dihedral angle that will produce the maximum percent energy in the 13.2 - 16.9 arc-second annulus additional perfect cubes with dihedral angles of 0.9, 1.25, and 1.75 arc-seconds were analyzed to provide range. In all cases the wavelength was assumed to be 6328Å and the input light was linearly polarized along a real edge. The computer output that resulted from the tolerance study is given in Appendix A.

Since the energy is to be maximized in the 13.2 - 16.9 arc-second annulus the encircled energies in this annulus were extracted from Appendix A and are given in tabular form in Table 1 and plotted versus dihedral angle in Figure 1. As may be seen from Figure 1 the peak encircled energy for a perfect cube occurs with a dihedral angle approximately 1.25 arc-seconds. In order to approximate the encircled energy over a wide range of dihedral angles, additional encircled energy tables were obtained for 0.0, 0.25, 0.5 and 0.75 arc-second dihedral angles. The encircled energy tables for these dihedral angles are also given in Appendix A.

---

* Dihedral angle as used in this report is the deviation from 90°

TABLE 1

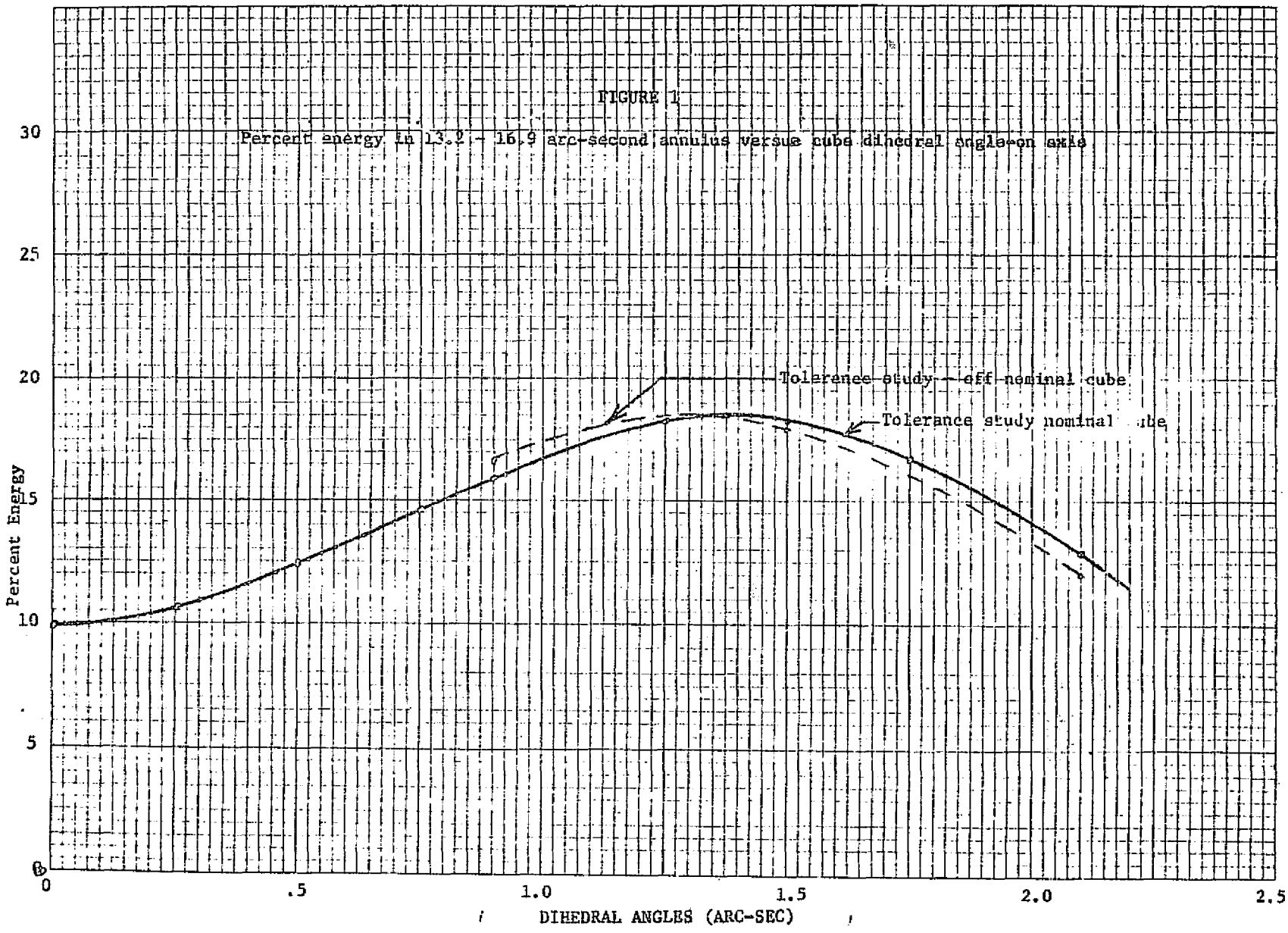
TOLERANCE STUDY

ENCIRCLED ENERGY & APPARENT
CENTROID DIAMETER
ON-AXIS

CASE	PERCENT ENERGY 13.2 - 16.8 ARC-SEC	APPARENT CENTROID DIAMETER (ARC-SEC)
0.9 Arc-Sec Nominal Cube	16.0	12.4
0.9 Arc-Sec Off Nominal Cube*	16.7	13.4
1.25 Arc-Sec Nominal Cube	18.3	14.4
1.5 Arc-Sec Nominal Cube	18.5	16.5
1.5 Arc-Sec Off Nominal Cube *	18.2	17.3
1.75 Arc-Sec Nominal Cube	16.8	18.6
2.1 Arc-Sec Nominal Cube	13.0	22.0
2.1 Arc-Sec Off Nominal Cube *	12.3	22.4

* .0, + .5, -.5, ARC-SEC ERRORS

FIGURE 1



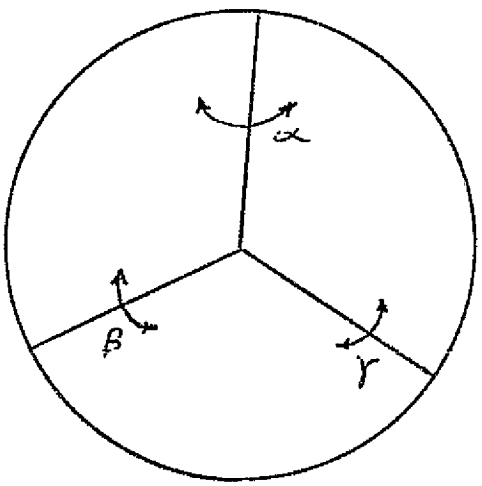
The cube was also analyzed with the three dihedral angles of the cube having different values as shown in Figure 2. The 1.5 arc second off nominal cube and the 2.1 arc-second off nominal cube were analyzed under the first phase of the contract. The results for a 0.9 arc-second off nominal cube are given in Appendix A. A plot of the encircled energy in the 13.2 - 16.9 arc-second annulus is denoted in figure 1 by the dashed line (----). Since the energy increases at an average dihedral angle value of 0.9 arc second and decreases at an average dihedral angle values of 1.5 and 2.1 arc seconds it is assumed that this variation in dihedral angles spreads the energy.

In order to verify the effect of variations in the dihedral angles on the energy distribution, the centroid of the annulus of energy was also obtained from the encircled energy curves. Here the annulus centroid is assumed to be the position of the maximum slope of the encircled energy curves. These values are also given in Table 1. The variation of annulus centroid diameter with cube dihedral angle is denoted by a solid line in Figure 3.

The diameter of the annulus centroid based upon a purely geometrical spread is also plotted in Figure 3 as a dashed line (----). It was proposed that the differences between the geometrical predictions and the analyses was caused by the combination of polarization and diffraction. If this were the case large dihedral angles on a retroreflector should produce the same annulus centroid diameter as the geometrical and polarization/diffraction based analyses. A cube with a dihedral angle of 5.0 arc-seconds produced matching annulus diameters (not shown on the graph) for both geometrical and analytical predictions (47.5 sec). In addition three cases were analyzed with no phase differences between the sectors due to polarization. The results of these analyses are noted in Figure 3 by the dotted squares (⊡). Since these values closely approximate the geometrical predictions, the conclusion is that deviations from the geometrical prediction are caused mainly by polarization and only slightly by diffraction in the dihedral angle range of interest.

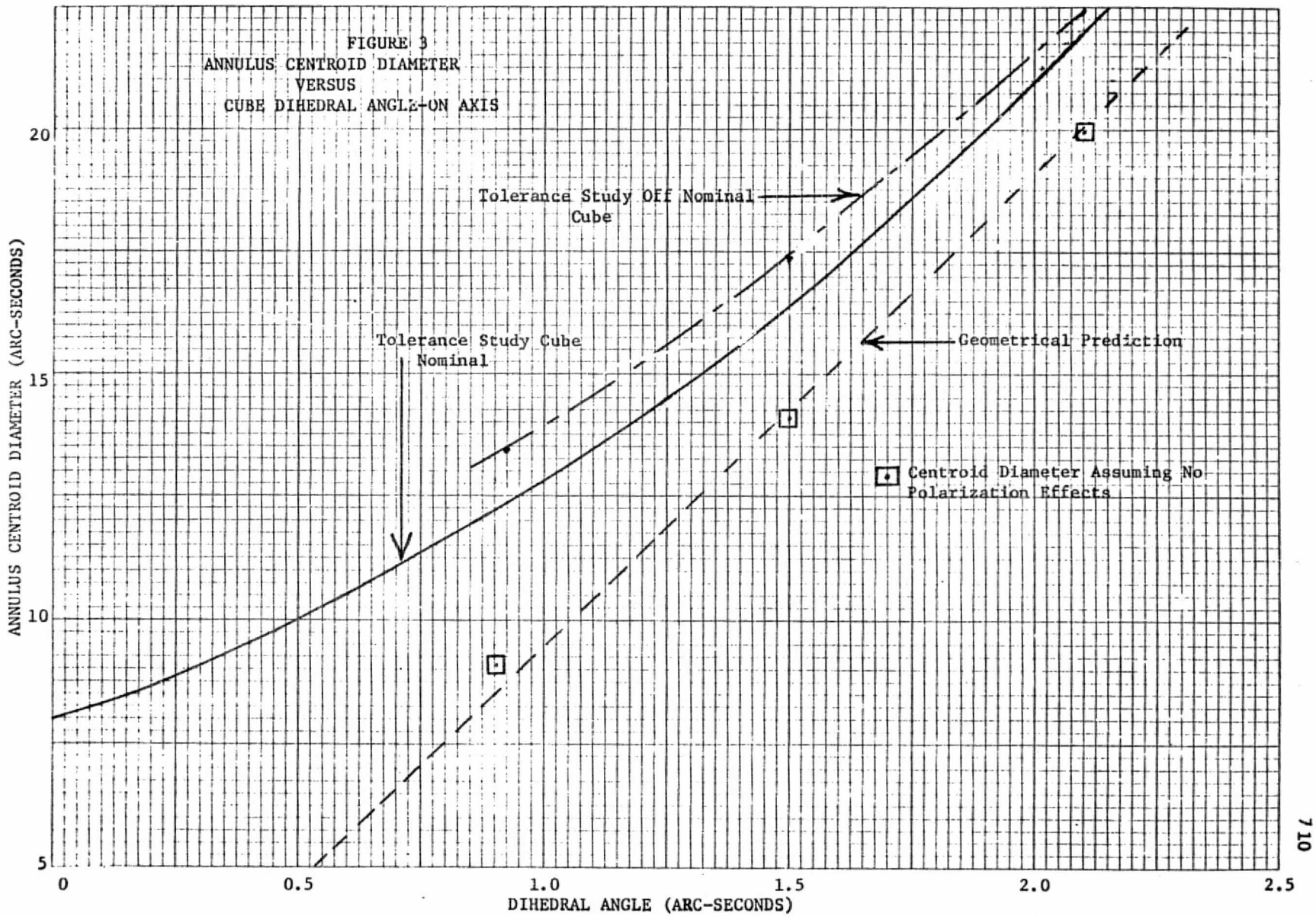
FIGURE 2

Dihedral angles used in the tolerance study of the off nominal cube corner retroreflector



	0.9 sec cube	1.5 sec cube	2.1 sec cube
α	0.9	1.5	~2.1
β	0.4	1.0	~1.6
δ	1.4	2.0	~ 2.6

FIGURE 3
ANNULUS CENTROID DIAMETER
VERSUS
CUBE DIHEDRAL ANGLE-ON AXIS



Cube Analysis

In addition to the tolerance study, analyses were made by Itek on six existing cubes for comparison with the tolerance study and previous measurements made by Bendix. The handling/cleaning procedure used involved the careful inspection and subsequent testing of the retroreflectors in a Twyman-Green Interferometer and the use of the resultant interferograms to predict the dihedral angles and the far field patterns of the cubes.

Test Procedure

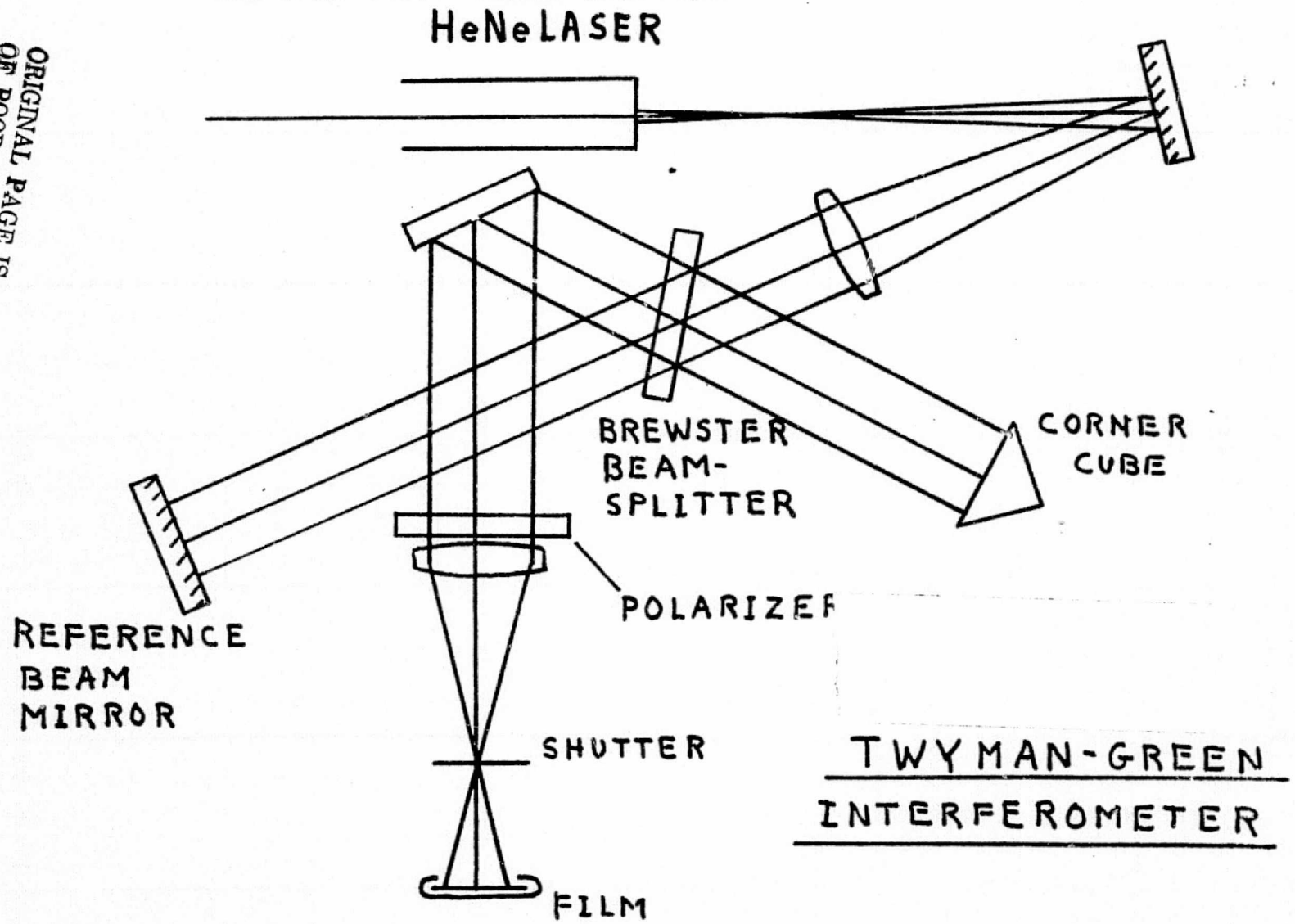
The schematic of the test setup of the Twyman Green Interferometer used in obtaining the interferograms is shown in Figure 4. The cube corner was carefully tilted approximately 1^{o} to avoid reflection off the front surface. The input beam to the cube was linearly polarized with the direction of polarization parallel to a real edge. The beam exiting the cube consisted of two orthogonal polarizations, one parallel to the input beam. The output beam was then linearly polarized in the same direction as the input beam in order to eliminate D.C. background from the other polarization. An air wedge was then obtained by tilting the reference mirror of figure 4 such that 4 - 5 fringes were obtained on the closed side of the air wedge. The interferometer was automatically calibrated prior to use due to the unique properties of the cube corner. This is discussed in more detail in appendix D.

After allowing 20 minutes for the gradients in the cube to stabilize three interferograms of each of the six retroreflectors were then taken with the air wedge in each of the three interferograms parallel to a different real edge. The position of the serial number on each cube was noted relative to the interferogram. A check was made of left-to-right reversal between the cube and the interferometer (due to a possible odd number of reflections in the test equipment) as a basis for any future identification of specific cube angles. The resultant interferograms are shown in Appendix B. These interferograms were used to predict the dihedral angles and the far field patterns of the cube corners.

Data was obtained from the interferograms by measuring the positions of the centers of the dark fringes at about 100 points approximately uniformly spaced over the interferogram. This was done with a two-coordinate precision measuring engine (David W. Mann Co., Hand Comparator, model 829C) with a digital readout having least count of 1μM. This was attached to an IBM model 026 card punch so that the data were obtained on punched cards directly. In general, the points were taken

FIGURE 4

TEST SETUP FOR INTERFEROMETRY OF LAGEOS CUBES # 1 - 6



along straight scans that were approximately orthogonal to the fringes. For each point, the relative order of the fringe was noted. The major error in this kind of measurement is in the ability of the operator to locate the center of the fringe. Past experience has shown that the repeatability of these measurements is generally less than 0.01 fringe rms and can be as small as 0.002 fringe rms for high contrast interferograms with low background noise. The measured data points were then interpolated on a grid for purposes of analysis.

It should be noted that because of the finite sampling of the wavefront, high frequency variations are not measured. This is expected to have no measurable effect on the determination of dihedral angle since this quantity is determined from the gross features of the surface. The effect on the energy in the annulus of interest is expected to be less than one percent of the total energy and the predicted energy would be consistently higher than the measured energy.

Dihedral Angle Determination

In a perfect cube corner with 90 degree dihedral angles, the exiting wavefronts from each sextant are plane and are parallel to one another. In addition, they are parallel to the incident wavefront. Any deviations in the dihedral angles result in deviations of the directions of the exiting wavefronts. In addition, the exiting wavefront is radially symmetric. That is, two points which are equidistant from the center and diametrically opposite have the same phase (we are ignoring polarization effects here because they do not affect the direction of the wavefront). This is because the paths for the two rays exiting at these points are identical and thus suffer the same retardation. These considerations can be used to find the dihedral angles from a measurement of the exiting wavefront.

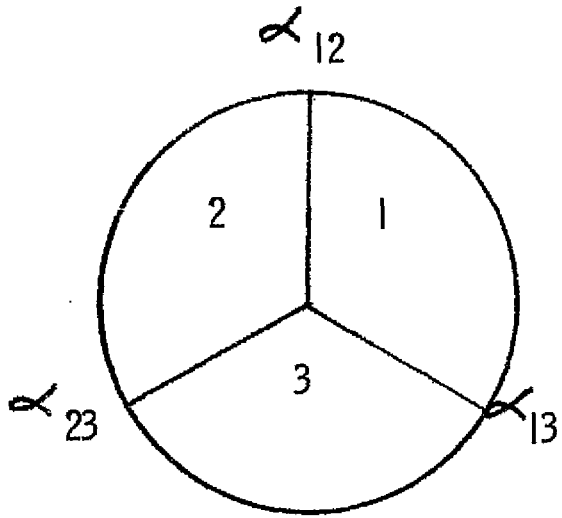
Assuming there are no surface errors on the reflecting surfaces, the wavefront can be defined by the OPD (Optical Path Difference) between a point on the wavefront at the center of the cube and a point on the wavefront at the edge of each of the three real edges. These values are noted in figure 5 by W_{12}, W_{13}, and W_{23}. These points are radially symmetric as previously described. These values may be obtained from an interferogram by counting the number of fringes from center to edge along each of the radial lines and taking into account the sign of the result according to whether the fringes represent increasing or decreasing path difference. The two opposite values are then averaged to cancel out the tilt in the reference beam (used to produce the fringes) and give radially symmetric results.

Since there are figure errors on the reflecting surfaces, the exiting wavefront sextants are not exactly plane, and thus the data reduction scheme described above cannot be used with any degree of precision. Therefore, the following procedure was used to determine the values of W_{12}, W_{13}, and W_{23}.

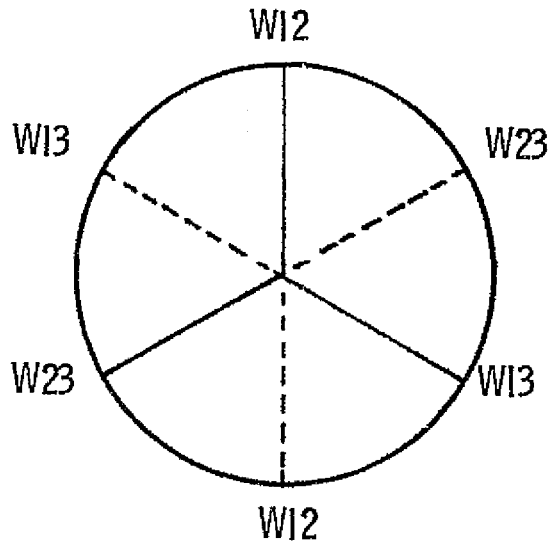
1. For each sextant, the fringes were digitized as described previously. This resulted in about 15-20 points in each sextant which gives OPD as a function of position.

FIGURE 5

CALCUATION OF DIHEDRAL ANGLES FROM INTERFEROGRAM



Cube



Wavefront

$$\alpha_{12} = \frac{1}{\sqrt{2}\,nD}\left[W_{13} + W_{23} - W_{12}\right]$$

$$\alpha_{13} = \frac{1}{\sqrt{2}\,nD}\left[W_{23} + W_{12} - W_{13}\right]$$

$$\alpha_{23} = \frac{1}{\sqrt{2}\,nD}\left[W_{12} + W_{13} - W_{23}\right]$$

TABLE 2

INTERFEROMETRIC MEASUREMENT OF DIHEDRAL ANGLES (ARC-SEC)

Cube	INTERFEROGRAM 1	2	3	Average	Ave.
1	1.38 1.71 1.87	1.53 1.68 2.01	1.63 1.90 1.98	1.51 1.76 1.95	1.74
2	1.62 2.19 2.03	1.64 1.91 1.82	1.77 2.00 2.08	1.68 2.03 1.98	1.90
3	1.32 1.30 1.61	1.30 1.38 1.59	1.38 1.53 1.53	1.33 1.40 1.58	1.44
4	1.83 1.67 1.87	1.86 1.87 1.76	1.86 1.72 1.92	1.85 1.75 1.85	1.82
5	2.24 2.38 2.01	2.23 2.28 1.94	2.19 2.10 1.88	2.22 2.25 1.94	2.14
6	1.76 1.64 1.51	1.50 1.68 1.59	1.56 1.44 1.65	1.61 1.59 1.58	1.59
				AVERAGE	1.77

(1 σ = .07 ARC-SEC)

2. A plane was fit through the measured data using least squares fitting techniques. This gives a representation of the plane wavefront which would exist if there were no errors but the dihedral angle errors.

3. The OPD at the edge of each radial line was determined from this plane. Since values could be obtained from two adjacent sextants, and since theoretically the two results should be the same, the two adjacent values were averaged.

4. Diametrically opposite values were averaged to cancel out the tilt in the reference beam and give radially symmetric results. These are the values for W_{12}, W_{13}, W_{23}.

5. The dihedral angles were found from the following relationship (See Appendix C)

$$\alpha_{12} = \frac{1}{\sqrt{2}\,ND}\,(W_{13} + W_{23} - W_{12})$$

$$\alpha_{13} = \frac{1}{\sqrt{2}\,ND}\,(W_{23} + W_{12} - W_{13})$$

$$\alpha_{23} = \frac{1}{\sqrt{2}\,ND}\,(W_{12} + W_{13} - W_{23})$$

where N is the index of refraction of the cube and D is the aperture diameter.

The dihedral angles of each cube were obtained from an average of the results obtained from the three interferograms of the cube. The values from each interferogram and the average for each dihedral angle are shown in Table 2.

In addition to the Itek measurement of the dihedral angle, mechanical measurements were made by Zygo Corporation and by Moore Special Tool Co. Also, an Itek analysis was made of interferograms produced by Zygo on cubes 1, 2, and 4. A comparison of these values are shown in Table 3. As may be seen from Table 3 the measurements may vary by as much as 0.5 arc-second. Since the interferometric analysis examines the exiting wavefront from the cube it is assumed to be more closely related to the far field performance of the cube. It is recommended, therefore, that interferometric measurement of the cube dihedral angles be used in future evaluations.

TABLE 3

COMPARISON OF DIHEDRAL ANGLE MEASUREMENTS ON CUBES 1, 2, and 4

Cube Corner I.D.#	Moore*	Zygo Mechanical* Operator #1	Zygo Mechanical* Operator #2	Itek Analysis Zygo** Interferograms	Itek Analysis Itek*** Interferograms
1	2.14	2.10	2.05	2.44	1.95
	2.00	1.67	1.89	2.04	1.76
	1.72	1.55	1.75	1.88	1.51
2	1.68	1.33	1.63	1.98	2.03
	1.84	1.38	1.81	1.76	1.98
	1.76	1.38	1.76	0.98	1.68
4	1.82	1.68	1.46	2.02	1.85
	1.80	1.24	1.30	1.31	1.75
	1.80	1.23	1.41	1.65	1.85

* The mechanically measured angles are based on five (5) measurements of each cube corner.

** Based on Itek analysis of one interferogram

*** Based on Itek analysis of three interferograms.

Far Field Pattern

The interferograms produced in the Twyman Green Interferometer were also used to predict the far field pattern of each cube. The procedure used was to evaluate the wavefronts from the three interferograms of each carefully aligned cube and average them to obtain the component of the wavefront parallel to the input beam (Q polarization). The theoretical phase shift due to polarization alone was then subtracted from this average wavefront to obtain the resultant surface error and dihedral angles. By adding the theoretical phase shift of the perpendicular component (P polarization) of the wavefront to the resultant wavefront, the perpendicular component of the wavefront of that cube was obtained.

The phase shift from sextant to sextant for the Q polarization was obtained from the evaluation of the interferograms and compared with the theoretical phase shift. As seen from Figure 6 the interferometric measurement of the phase shift agreed with the theoretical phase shift within $\pm$ 0.02λ as measured at a wavelength of 0.6328μ. A separate analysis showed that phase shift errors of this magnitude have no discernible effect on the far field pattern.

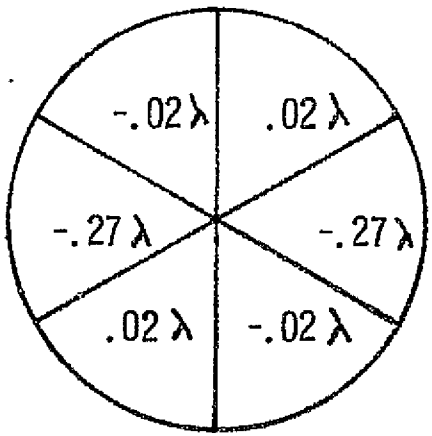
The far field patterns of the P and Q polarizations were then calculated from the wavefronts using the theoretical amplitude variations and added to give the total far field pattern. The computer output for cubes number 1 - 6 are given in Appendix A.

The primary values of interest are the encircled energy in the 13.2 - 16.9 arc-second annulus and the apparent annulus centroid diameter of the far field pattern. These values are tabulated in Table 4. The analytically predicted encircled energy in the 13.2 - 16.9 arc second annulus for each cube is plotted on Figure 7 at the cube average dihedral angle predicted by Itek's interferometric analysis. These values are noted by the dotted circles (⊙). Also plotted on Figure 7 are the measurements of the encircled energy by Bendix. These are noted by the dotted triangles (△) and are plotted at the cube average dihedral angle predicted by Itek's interferometric analysis. In all of the six cubes the measured encircled energy is lower than the analytically predicted encircled energy.

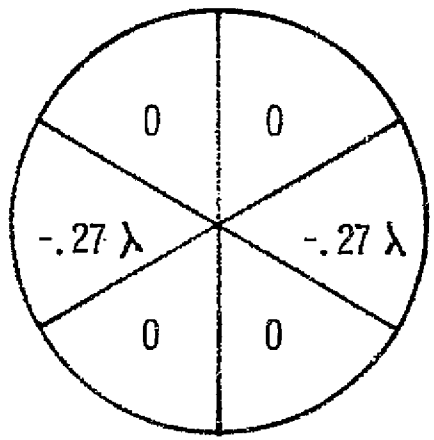
FIGURE 6

PHASE SHIFT DUE TO POLARIZATION

Q POLARIZATION
(cf. Text)



Interferometric
Measurement
($1\sigma = .02\lambda$)



Theoretical

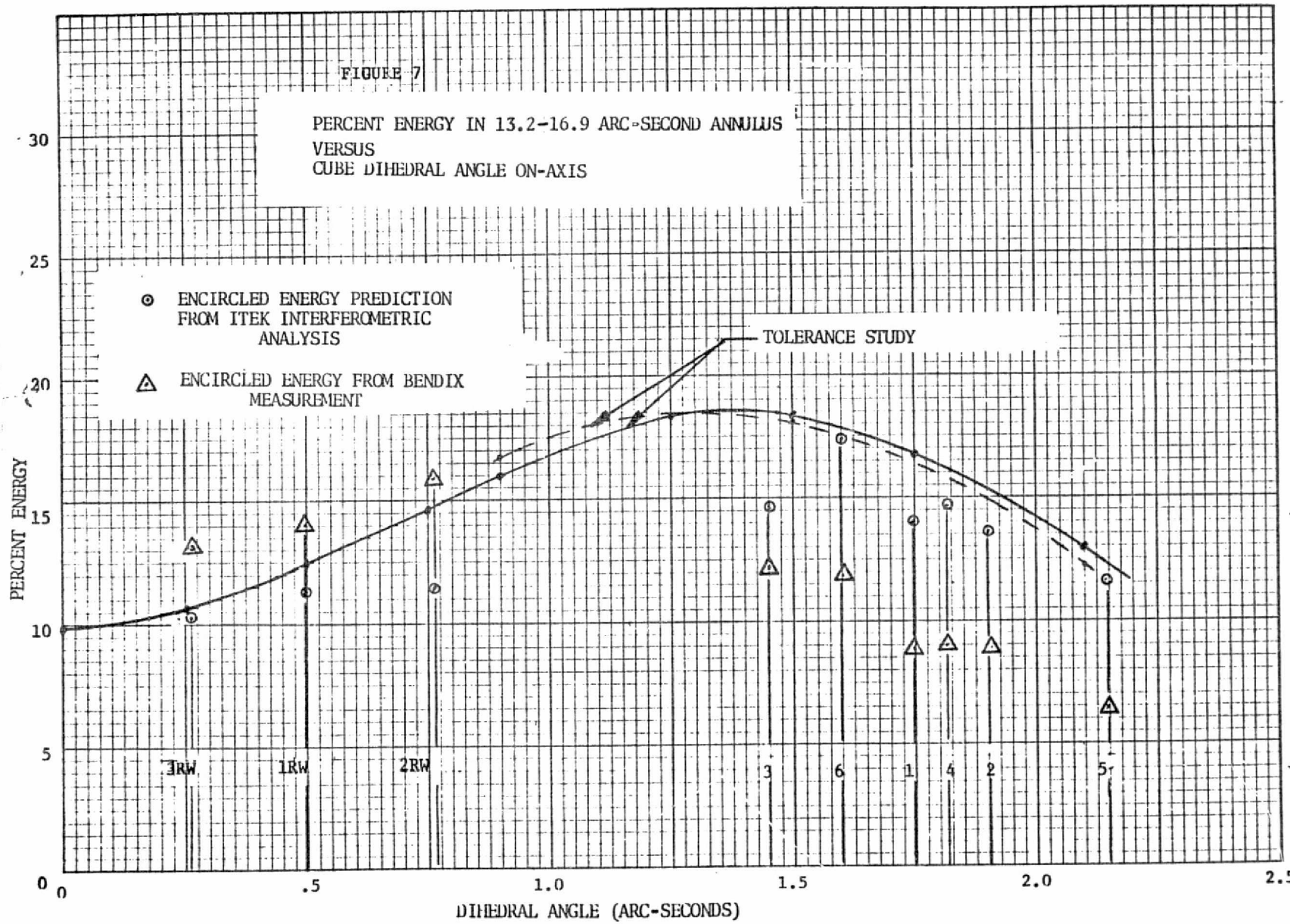
TABLE 4

FAR FIELD CHARACTERISTICS OF LAGEOS
RETROREFLECTOR - ON-AXIS

Cube#	Percent Energy 13.2 - 16.9 Arc-Sec Itek Interferogram	Bendix Measurement	Annulus Diameter (Arc-Sec) Itek Interferogram	Bendix Measurement
1	14.0	8.9	18.6	22.0
2	13.6	8.9	20.2	19.8
3	14.7	12.4	16.4	17.6
4	14.6	9.0	18.6	20.6
5	11.7	6.7	21.9	23.5
6	17.4	12.0	16.6	18.4
AVERAGE	14.3	9.7	18.3	20.3

FIGURE 7

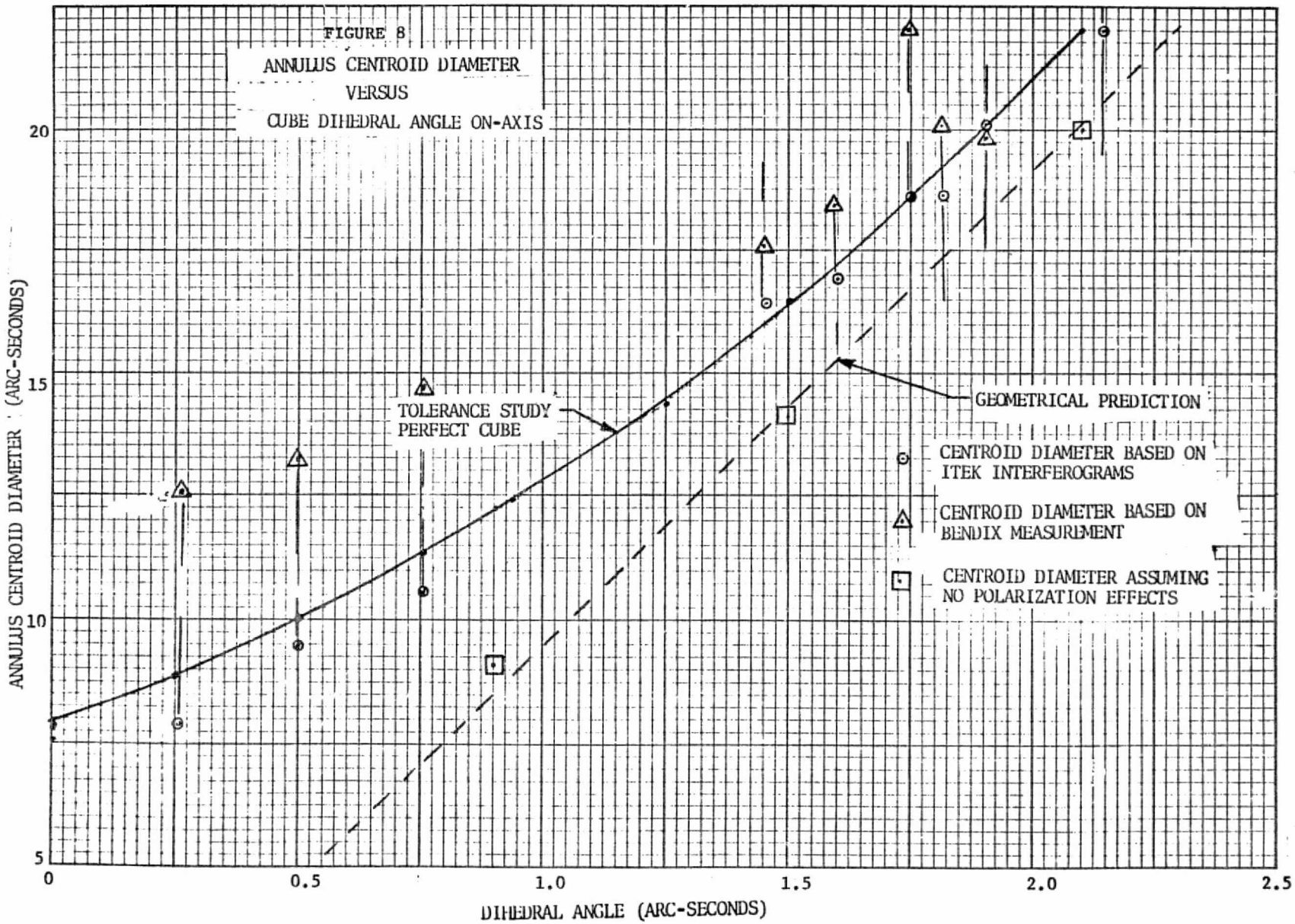
PERCENT ENERGY IN 13.2-16.9 ARC-SECOND ANNULUS
VERSUS
CUBE DIHEDRAL ANGLE ON-AXIS



The analytically predicted annulus centroid diameter was determined by estimating the position of the maximum slopes of the encircled energy curves of the cube corners. These values are plotted at the Itek predicted cube average dihedral angle in Figure 8 and are noted by the dotted circles (⊙). The Bendix measurements of the annulus centroid diameter are noted by the dotted triangles (△) in Figure 8. The measured annulus centroid diameters for the majority of the cubes are larger than the analytically predicted diameters.

FIGURE 8

ANNULUS CENTROID DIAMETER
VERSUS
CUBE DIHEDRAL ANGLE ON-AXIS



Cube Rework

The tolerance study (Figure 1) indicated the peak encircled energy in the 13.2 - 16.9 arc-second annulus occurs with a dihedral angle of about 1.35 arc-seconds. The average dihedral angle of the six cubes was 1.8 arc-seconds with the smallest value being 1.44 arc-seconds. Since no data was available at dihedral angles below 1.35 arc-seconds, three of the original cubes were reworked by Zygo to attempt to obtain cube average dihedral angles of 0.75, 1.00 and 1.25 arc-seconds.

Three interferograms of the reworked cubes were taken by Zygo and sent to Itek for analysis. In these interferograms the input beam to the cube was linearly polarized with the direction of polarization parallel to a different real edge for each interferogram, (i.e. the cube was rotated 120° after each interferogram and before the subsequent interferogram). The interferograms for the three reworked cubes are shown in Appendix B. The dihedral angles were determined using Itek's interferometric analysis and are shown in Table 5. The average cube dihedral angles were 0.23, 0.49 and 0.76 sec as based upon Itek interferometry. (Mechanical measurements showed a consistent 0.5 arc-sec bias relative to the interferometric data reduction).

In order to analyze the far field pattern of the reworked cubes, the wavefront calculated from each of the interferograms of a cube were averaged. This cancelled out the phase shift due to polarization resulting in the effects only due to surface errors and dihedral angles. The theoretical phase shifts for the P and Q polarizations were each added to the resultant average wavefront to obtain the exiting P and Q wavefronts. The computer output for the analysis of the reworked cubes is given in Appendix A.

The encircled energy in the 13.2 - 16.9 sec annulus and apparent annulus centroid diameter resulting from the Itek analysis and from Bendix measurements are shown in Table 6. The encircled energy in the 13.2 - 16.9 arc-second annulus is also plotted in Figure 7 as denoted by the dotted circles (⊙) for the Itek analysis and dotted triangles (△) for the Bendix measurements. In this case the encircled energy in the Bendix measurement was lower than the Itek analysis. Since the larger dihedral angles show smaller measurements and the smaller dihedral angles show larger measured data, the annulus diameter is possibly incorrect in either the Itek annulus assumptions or in the Bendix measurement.

TABLE 5

INTERFEROMETRIC MEASUREMENT OF DIHEDRAL ANGLES

ON REWORKED CUBES (ARC-SEC)

REWORKED CUBE	INTERFEROGRAM 1			2			3			Average			Ave.
1	.73	.30	.45	.79	.38	.33	.83	.28	.30	.78	.32	.36	.49
2	.67	.89	.77	.58	.91	.73	.91	.79	.59	.72	.86	.70	.76
3	.28	.17	.40	.24	.30	.16	.25	.26	.30	.26	.24	.29	.26

BASED ON INTERFEROGRAM PRODUCED BY ZYGO AND ANALYZED BY ITEK

TABLE 6

FAR FIELD CHARACTERISTICS OF
REWORKED CUBES ON AXIS

REWORKED CUBE	PERCENT ENERGY 13.2 - 16.9 ARC SEC		CENTROID DIAMETER (ARC-SEC)	
	ITEK INTERFEROGRAM	BENDIX MEASUREMENT	ITEK INTERFEROGRAM	BENDIX MEASURED
1	11.35	14.0	9.4	13.2
2	11.5	16.0	10.5	14.7
3	10.4	13.0	7.9	12.5

BASED ON INTERFEROGRAM PRODUCED BY ZYGO AND ANALYZED BY ITEK

If the annulus were smaller than assumed the deviations shown in Figure 7 would occur. To this date the discrepancy has not been resolved.

The apparent annulus centroid diameters for the reworked cubes are noted in Figure 8 by dotted circles (⊙) for the Itek analysis and dotted triangles (△) for the Bendix measurement. The Bendix measurements indicate a much larger annulus centroid diameter than the assumed value in the Itek analysis. This conclusion agrees with the conclusion arrived at from the encircled energy data.

Summary/Recommendations

One purpose of this study was to resolve apparent contradictions between experimental test results and simplified geometrical predictions. A major portion of the differences was caused by polarization effects. A smaller contradiction still exists between the analysis and test. This difference may be caused by a test annulus which is smaller than assumed. This discrepancy has not as yet been resolved.

Another purpose of the study was to recommend a cube dihedral angle that produces the maximum energy in the 13.2 - 16.9 arc-second annulus. Based upon Figure 25, a cube with all dihedral angles the same would produce the maximum energy with a1.35 arc second annulus. Since variations in dihedral angles tend to spread the energy (Figure 25) a better choice for average dihedral angles would be 1.25 arc-seconds.

A discrepancy was also noted between interferometric measurements of the dihedral angles and mechanical measurements. Since the interferometric measurements measure the output from the cube while the mechanical measurements are taken on the back faces of the cube it is recommended that interferometric measurements be used in determining cube dihedral angles, as the results should tie more closely to far field performance.

APPENDIX A

Computer Output of Cases Analyzed

This appendix includes the computer output resulting from the tolerance analyses and the cube interferometric analyses. Table A1 provides a reference for locating figures and tables that apply to different cases.

The tolerance study for cubes with all dihedral angles the same are shown in Figures A1 - A24 and Tables A2 - A7. The off-nominal cube with dihedral angle variations of 0.0, + 0.5 arc sec and - 0.5 sec discussed in the text of the report are given in Figures A25 - A32 and Tables A8 and A9. Also included in this appendix but not shown in Table A1 were encircled energy tables for dihedral angles of 0.0, 0.25, 0.5 and 0.75 $\widehat{\text{sec}}$. There are shown in Tables A10 and A11, Tables A12 and A13, Tables A14 and A15, and Tables A16 and A17 respectively.

The computer output resulting from the interferometric analysis of the six initial cubes are shown in Figures A33 - A80 and Tables A18 - A29. The three cubes that were reworked after an analysis of the six initial cubes are shown in Figures A81 - A104 and Tables A30 - A35.

TABLE A1

Figure numbers and tables that give the performance of the specified cases

Case	Wavefront Maps	Wavefront Plots	Intensity Maps	Intensity Plots	Encircled Energy Plots	Encircled Energy Tables
	Fig. No.:	Fig. No.:	Fig. No.:	Fig. No.:	Fig. No.:	Table No.:
0.9 arc-second nominal cube	A1, A3	A2, A4	A5	A6, A7	A8	A2, A3
1.25 arc second nominal cube	A9, A11	A10, A12	A13	A14, A15	A16	A4, A5
1.75 arc second nominal cube	A17, A19	A18, A20	A21	A22, A23	A24	A6, A7
0.9 arc second nominal cube	A25, A27	A26, A28	A29	A30, A31	A32	A8, A9
Cube #1	A33, A35	A34, A36	A37	A38, A39	A40	A18, A19
Cube #2	A41, A43	A42, A44	A48	A46, A47	A48	A20, A21
Cube #3	A49, A51	A50, A52	A53	A54, A55	A56	A22, A23
Cube #4	A57, A59	A58, A60	A61	A62, A63	A64	A24, A25
Cube #5	A65, A67	A66, A68	A69	A70, A71	A72	A26, A27
Cube #6	A73, A75	A74, A76	A77	A78, A79	A80	A28, A29
Cube #1RW	A81, A83	A82, A84	A85	A86, A87	A88	A30, A31
Cube #2RW	A89, A91	A90, A92	A93	A94, A95	A96	A32, A33
Cube #3RW	A97, A99	A98, A100	A101	A102, A103	A104	A34, A35

Figures A1

0.9 Arc-Second Nominal Cube

Wavefront Map - Q Polarization

MAP IN UNITS OF 0.01 WAVES

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							17	15	13	11	9	7	5	2	0	0	2	5	7	9	11	13	15	17								
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					14	12	10	8	6	4	2	0	-2	-4	-6	-6	-4	-2	0	2	4	6	8	10	12	14							
				12	10	8	6	4	2	0	-1	-3	-5	-7	-9	-9	-7	-5	-3	-1	0	2	4	6	8	10	12						
			11	9	7	5	3	1	0	-2	-5	-7	-9	-11	-13	-13	-11	-9	-7	-5	-2	0	1	3	5	7	9	11					
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		84	80	75	0	-1	-3	-5	-7	-10	-12	-14	-16	-18	-20	-20	-18	-16	-14	-12	-10	-7	-5	-3	-1	0	75	80	84				
		84	80	75	71	-5	-7	-9	-11	-13	-15	-17	-19	-21	-23	-23	-21	-19	-17	-15	-13	-11	-9	-7	-5	71	75	80	84				
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							17	15	13	11	9	7	5	2	0	0	2	5	7	9	11	13	15	17								
								18	16	14	12	10	8	6	4	4	6	8	10	12	14	16	18								
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Figure A2

Wavefront Plot – Q Polarization

0.9 Arc-Second Nominal Cube

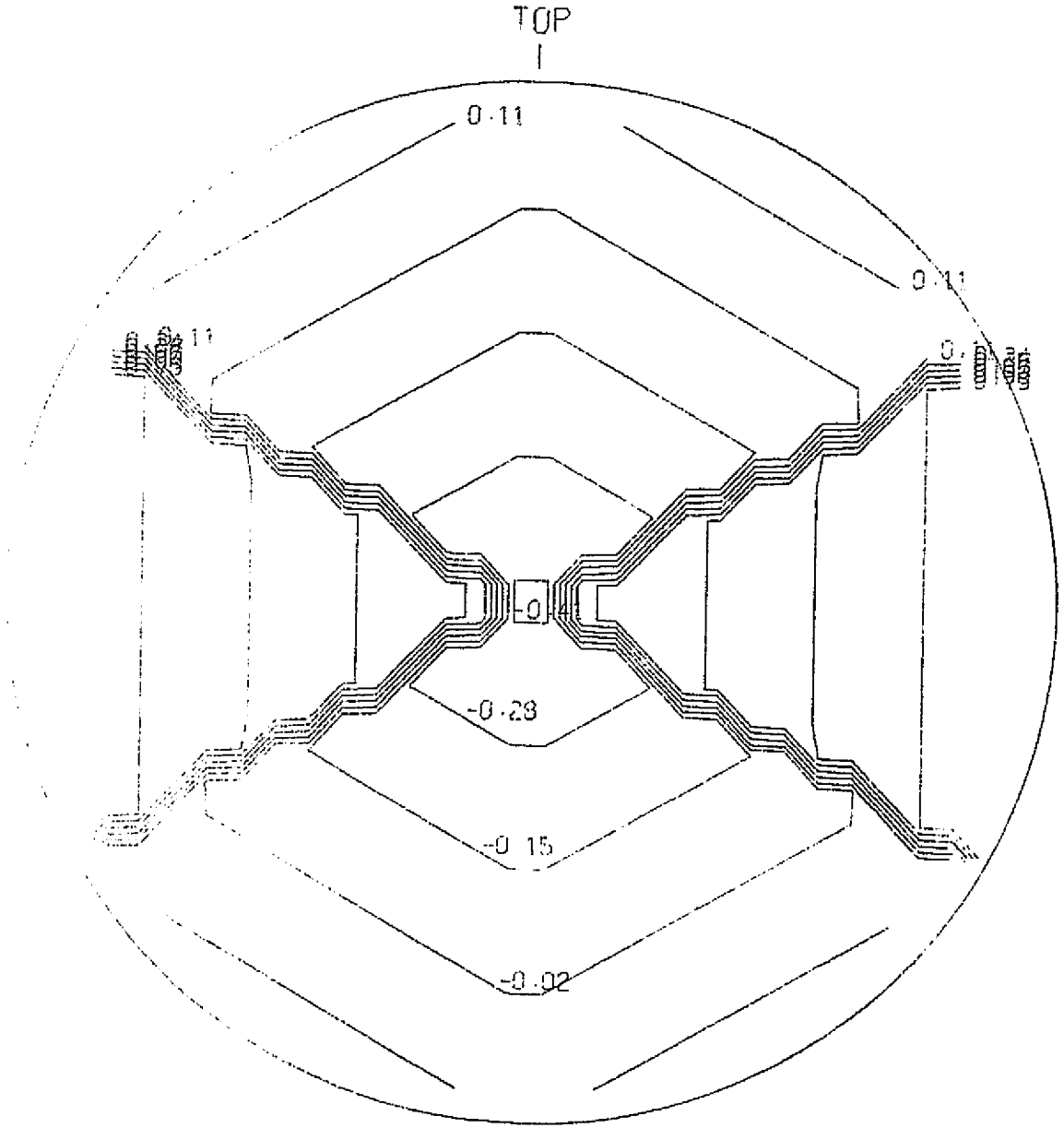

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Figure A3

Wavefront Map – P Polarization

0.9 Arc-Second Nominal Cube

MAP IN UNITS OF 0.01 WAVES

										74	72	70	68	66	16	18	20	22	24										
							77	75	73	71	69	67	65	62	12	15	17	19	21	23	25	27							
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		69	67	65	63	61	59	57	55	53	51	49	47	45	-4	-2	0	1	3	5	7	9	11	13	15	17	19		
	100	66	64	62	60	58	56	54	51	49	47	45	43	41	-8	-6	-4	-2	0	1	4	6	8	10	12	14	16	50	
	100	96	91	58	56	54	52	50	48	46	44	42	40	38	-11	-9	-7	-5	-3	-1	0	2	4	6	8	42	46	50	
	100	96	91	87	53	51	49	46	44	42	40	38	36	34	-15	-13	-11	-9	-7	-5	-3	0	1	3	37	42	46	50	
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							38	36	34	32	30	28	26	24	74	76	78	80	82	84	86	88							
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Figure A4

0.9 Arc-Second Nominal Cube

Wavefront Plot - P Polarization

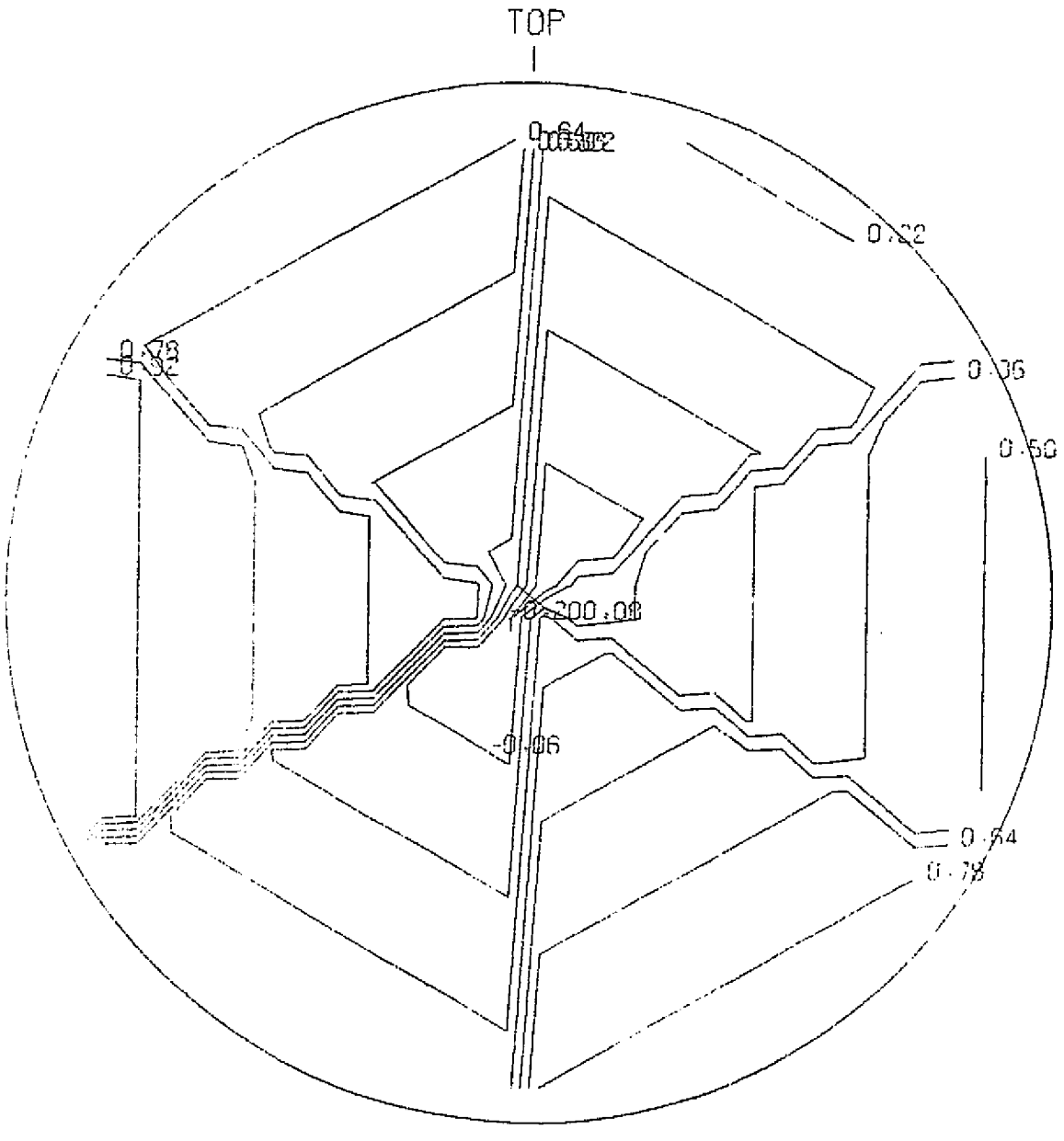

Figure A5

PRINTER MAP OF POINT SPREAD FUNCTION
0.9 Arc-Second Nominal Cube
(ONE SPACE REPRESENTS 8.04 MICRONS)
NORMALIZED SO LARGEST VALUE = 0.0554 = 100
TOTAL ENERGY = 0.2461000D+01
MAP REPRESENTS 0.2316480D+01 OR 94.1276 PERCENT OF TOTAL ENERGY

```
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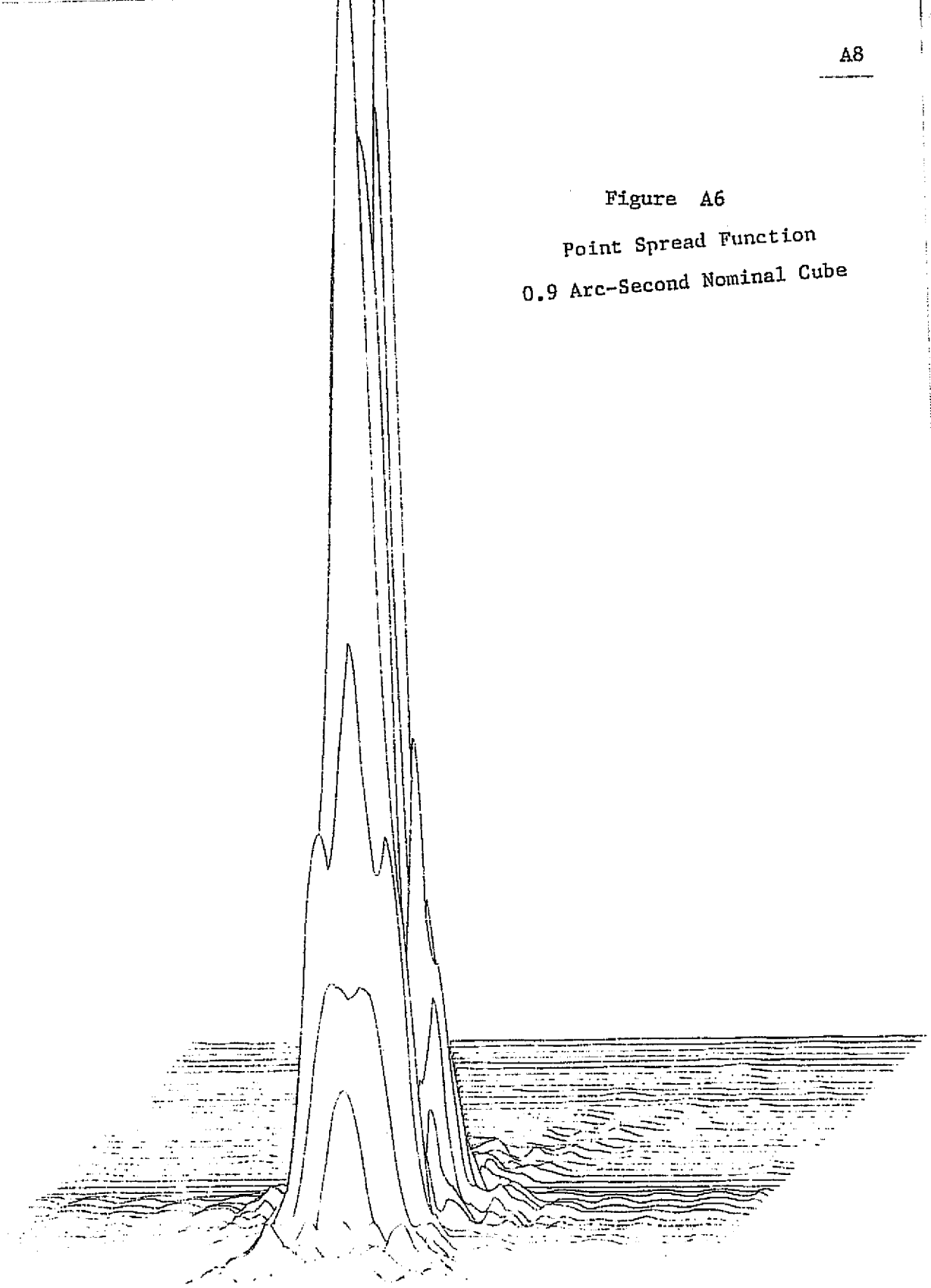


Figure A6

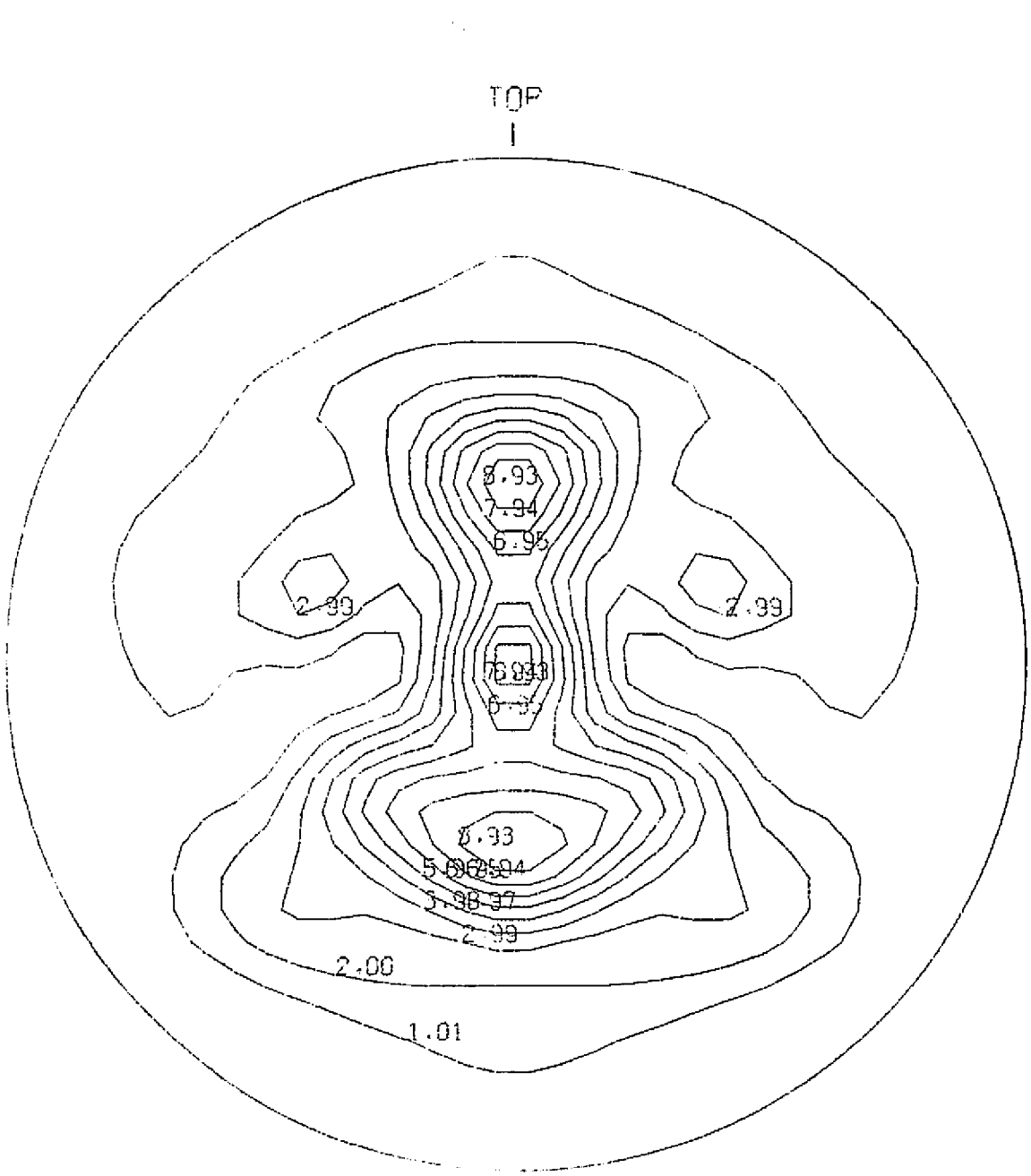
Point Spread Function

0.9 Arc-Second Nominal Cube

Figure A7

0.9 Arc-Second Nominal Cube

Intensity Distribution - Central 129 Microradians



46 1472

Figure A8

Encircled Energy
Vs
Field Angle
0.9 Arc-Second Nominal Cube

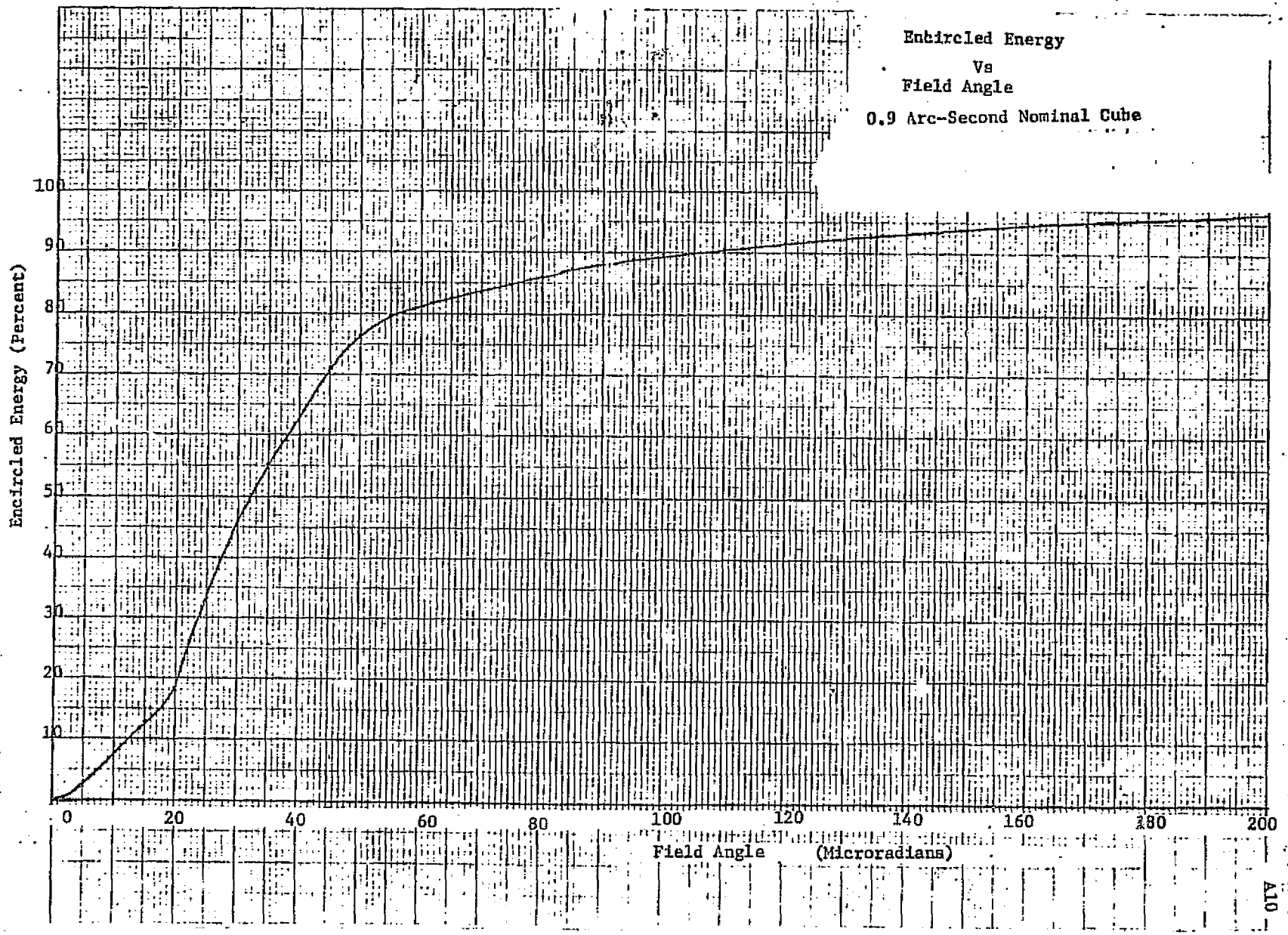


Table A2

ENCIRCLED ENERGY

0.9 Arc-Second Nominal Cube

CIRCLE RADIUS (MICRONS)	PERCENT ENERGY WITHIN CIRCLE CENTERED AT INDICATED COORDINATES								
CENTER (MICRONS): X=	-10.13	10.13	0.0	-10.13	0.0	10.13	0.0	-10.13	10.13
Y=	-10.13	-10.13	-10.13	0.0	0.0	0.0	10.13	10.13	10.13
2.00	0.0	0.0	0.4	0.1	0.6	0.1	0.4	0.0	0.0
4.00	0.6	0.6	0.8	0.3	0.6	0.3	0.8	1.1	1.1
6.00	1.6	1.6	2.5	1.0	4.1	1.0	2.7	1.1	1.1
8.00	2.3	2.3	4.6	2.4	4.1	2.4	4.9	3.6	3.6
10.00	3.2	3.2	5.9	3.1	7.6	3.1	6.7	4.9	4.8
12.00	7.5	7.5	9.3	5.7	8.5	5.7	10.6	9.9	9.9
14.00	7.5	7.5	11.5	8.9	11.2	8.9	14.3	9.9	9.9
16.00	12.9	12.9	15.0	11.6	13.0	11.6	18.2	15.7	15.6
18.00	15.2	15.2	17.1	15.2	18.7	15.2	21.3	18.3	18.2
20.00	19.3	19.3	21.6	19.1	18.7	19.1	26.1	22.5	22.5
22.00	21.5	21.5	23.9	24.1	26.4	24.1	28.8	25.0	25.0
24.00	26.2	26.2	27.2	26.5	29.5	26.5	32.0	29.8	29.8
26.00	28.4	28.3	30.4	32.3	37.1	32.2	34.7	32.3	32.3
28.00	33.2	33.2	35.3	37.5	39.0	37.5	39.6	36.9	36.8
30.00	36.5	36.5	38.6	42.3	45.8	42.3	41.8	40.5	40.5
32.00	42.7	42.7	43.3	45.9	48.5	45.9	46.3	46.0	46.0
34.00	43.9	43.8	47.0	51.2	52.6	51.1	49.5	47.3	47.3
36.00	50.2	50.2	51.9	54.6	56.1	54.6	54.4	52.7	52.7
38.00	52.9	52.9	55.3	58.3	60.2	58.3	57.0	55.2	55.2
40.00	57.3	57.3	59.3	61.4	62.3	61.4	61.2	59.2	59.2
42.00	59.7	59.7	62.6	64.9	66.6	64.9	64.1	61.3	61.3
44.00	63.7	63.7	65.1	66.5	69.0	66.5	66.9	64.9	64.9
46.00	66.0	66.0	67.9	69.5	72.7	69.5	69.4	67.1	67.1
48.00	68.8	68.8	70.6	71.8	73.7	71.8	71.9	69.9	69.9
50.00	70.9	70.9	72.4	73.4	76.4	73.4	73.3	71.9	71.9
52.00	73.1	73.1	74.7	75.4	77.4	75.4	75.4	73.8	73.8
54.00	74.4	74.4	76.5	76.9	78.9	76.9	76.7	75.1	75.1
56.00	76.6	76.6	78.5	78.6	79.6	78.6	78.3	76.8	76.8
58.00	78.0	78.0	79.5	79.4	80.6	79.4	79.2	78.1	78.1
60.00	79.4	79.4	80.7	80.5	81.2	80.5	80.3	79.2	79.2
62.00	80.3	80.3	81.4	81.2	81.8	81.2	81.0	80.1	80.1
64.00	81.5	81.5	82.0	81.8	82.4	81.8	81.7	81.2	81.2
66.00	82.2	82.2	82.6	82.5	82.9	82.5	82.5	82.0	82.0
68.00	82.9	82.9	83.1	83.0	83.2	83.0	83.1	82.8	82.8
70.00	83.3	83.3	83.6	83.5	83.7	83.5	83.7	83.3	83.3
72.00	84.0	84.0	84.0	84.0	84.1	84.0	84.2	84.0	84.0
74.00	84.3	84.3	84.5	84.6	84.6	84.6	84.8	84.4	84.4
76.00	84.9	84.9	84.9	85.1	85.0	85.1	85.3	85.0	85.0
78.00	85.3	85.3	85.3	85.5	85.6	85.5	85.6	85.5	85.5
80.00	85.7	85.7	85.7	85.9	86.0	85.9	86.0	85.9	85.9

Table A3

ENCIRCLED ENERGY

0.9 Arc-Second Nominal Cube

CIRCLE RADIUS (MICRONS)	PERCENT ENERGY WITHIN CIRCLE CENTERED AT INDICATED COORDINATES								
CENTER (MICRONS): X=	-10.13	10.13	0.0	-10.13	0.0	10.13	0.0	-10.13	10.13
Y=	-10.13	-10.13	-10.13	0.0	0.0	0.0	10.13	10.13	10.13
5.00	0.6	0.6	2.0	1.0	2.5	1.0	2.2	1.1	1.1
10.00	3.2	3.2	5.9	3.1	7.6	3.1	6.7	4.9	4.8
15.00	10.8	10.8	14.4	10.4	13.0	10.4	17.1	13.3	13.3
20.00	19.3	19.3	21.6	19.1	18.7	19.1	26.1	22.5	22.5
25.00	27.7	27.6	29.4	31.7	33.1	31.6	34.1	31.4	31.4
30.00	36.5	36.5	38.6	42.3	45.8	42.3	41.8	40.5	40.5
35.00	47.9	47.9	49.8	52.1	55.2	52.1	51.8	50.4	50.4
40.00	57.3	57.3	59.3	61.4	62.3	61.4	61.2	59.2	59.2
45.00	65.0	65.0	66.7	68.5	71.1	68.5	68.3	66.3	66.3
50.00	70.9	70.9	72.4	73.4	76.4	73.4	73.3	71.9	71.9
55.00	75.8	75.8	77.6	77.9	79.4	77.9	77.7	76.1	76.1
60.00	79.4	79.4	80.7	80.5	81.2	80.5	80.3	79.2	79.2
65.00	81.8	81.8	82.4	82.2	82.7	82.2	82.2	81.6	81.6
70.00	83.3	83.3	83.6	83.5	83.7	83.5	83.7	83.3	83.3
75.00	84.6	84.6	84.7	84.9	84.8	84.9	85.0	84.8	84.8
80.00	85.7	85.7	85.7	85.9	86.0	85.9	86.0	85.9	85.9
85.00	86.7	86.7	86.9	87.1	87.3	87.1	87.0	86.8	86.8
90.00	87.6	87.6	87.9	88.0	88.2	88.0	87.9	87.7	87.7
95.00	88.6	88.6	88.7	88.7	88.9	88.7	88.6	88.5	88.5
100.00	89.3	89.3	89.4	89.3	89.5	89.3	89.3	89.2	89.2
105.00	89.8	89.8	90.0	89.9	89.9	89.9	90.0	89.8	89.8
110.00	90.4	90.4	90.4	90.4	90.5	90.4	90.6	90.5	90.5
115.00	90.9	90.9	90.8	91.0	91.0	91.0	91.0	91.0	91.0
120.00	91.3	91.3	91.3	91.5	91.5	91.5	91.4	91.4	91.4
125.00	91.8	91.8	91.9	91.9	91.9	91.9	91.9	91.8	91.8
130.00	92.2	92.2	92.3	92.2	92.3	92.2	92.3	92.2	92.2
135.00	92.6	92.6	92.6	92.6	92.7	92.6	92.6	92.6	92.6
140.00	93.0	93.0	93.0	93.0	92.9	93.0	93.0	92.9	92.9
145.00	93.3	93.3	93.3	93.3	93.2	93.3	93.2	93.2	93.2
150.00	93.6	93.6	93.6	93.6	93.7	93.6	93.6	93.6	93.6
155.00	93.9	93.9	93.9	93.9	94.0	93.9	93.9	93.9	93.9
160.00	94.2	94.2	94.2	94.3	94.3	94.3	94.2	94.2	94.2
165.00	94.5	94.5	94.6	94.6	94.6	94.6	94.6	94.6	94.6
170.00	94.8	94.8	94.8	94.8	94.9	94.8	94.9	94.8	94.8
175.00	95.1	95.1	95.1	95.1	95.1	95.1	95.1	95.1	95.1
180.00	95.4	95.4	95.3	95.4	95.4	95.4	95.3	95.3	95.3
184.99	95.6	95.6	95.5	95.6	95.6	95.6	95.5	95.6	95.6
189.99	95.8	95.8	95.9	95.8	95.9	95.8	95.9	95.8	95.8
194.99	96.0	96.0	96.1	96.0	96.1	96.0	96.1	96.0	96.0
199.99	96.3	96.3	96.3	96.3	96.3	96.3	96.3	96.3	96.3

Figure A9

Wavefront Map - Q Polarization

1.25 Arc-Second Nominal Cube

MAP IN UNITS OF 0.01 WAVES

```
                                                39 36 33 31 28 28 31 33 36 39
                                          43 40 37 34 31 29 26 23 23 26 29 31 34 37 40 43
                                       41 38 35 32 29 26 24 21 18 18 21 24 26 29 32 35 38 41
                                    39 36 33 30 27 24 22 19 16 13 13 16 19 22 24 27 30 33 36 39
                                 36 34 31 28 25 22 20 17 14 11  8  8 11 14 17 20 22 25 28 31 34 36
                              34 32 29 26 23 20 17 15 12  9  6  3  3  6  9 12 15 17 20 23 26 29 32 34
                           32 30 27 24 21 18 15 13 10  7  4  1 -1 -1  1  4  7 10 13 15 18 21 24 27 30 32
                        105 27 25 22 19 16 13 10  8  5  2  0 -3 -5 -5 -3  0  2  5  8 10 13 16 19 22 25 27 105
                        105 99 94 17 14 11  8  6  3  0 -2 -5 -8 -10 -10 -8 -5 -2  0  3  6  8 11 14 17 94 99 105
                        105 99 94 88  9  6  4  1 -1 -4 -7 -10 -13 -15 -15 -13 -10 -7 -4 -1  1  4  6  9 88 94 99 105
                     111 105 99 94 89 82 77  0 -3 -6 -9 -12 -15 -17 -20 -20 -17 -15 -12 -9 -6 -3  0 77 82 88 94 99 105 111
                     111 105 99 94 88 82 77 71 65 -11 -14 -17 -19 -22 -25 -25 -22 -19 -17 -14 -11 65 71 77 82 88 94 99 105 111
                     111 105 99 94 88 82 77 71 65 60 54 -22 -24 -27 -30 -30 -27 -24 -22 54 60 65 71 77 82 88 94 99 105 111
                     111 105 99 94 88 82 77 71 65 60 54 48 -29 -32 -35 -35 -32 -29 48 54 60 65 71 77 82 88 94 99 105 111
                     111 105 99 94 88 82 77 71 65 60 54 48 43 37 -40 -40 37 43 48 54 60 65 71 77 82 88 94 99 105 111
                     111 105 99 94 88 82 77 71 65 60 54 48 43 37 -40 -40 37 43 48 54 60 65 71 77 82 88 94 99 105 111
                     111 105 99 94 88 82 77 71 65 60 54 48 -29 -32 -35 -35 -32 -29 48 54 60 65 71 77 82 88 94 99 105 111
                     111 105 99 94 88 82 77 71 65 60 54 -22 -24 -27 -30 -30 -27 -24 -22 54 60 65 71 77 82 88 94 99 105 111
                     111 105 99 94 88 82 77 71 65 -11 -14 -17 -19 -22 -25 -25 -22 -19 -17 -14 -11 65 71 77 82 88 94 99 105 111
                     111 105 99 94 88 82 77  0 -3 -6 -9 -12 -15 -17 -20 -20 -17 -15 -12 -9 -6 -3  0 77 82 88 94 99 105 111
                        105 99 94 88  9  6  4  1 -1 -4 -7 -10 -13 -15 -15 -13 -10 -7 -4 -1  1  4  6  9 88 94 99 105
                        105 99 94 17 14 11  8  6  3  0 -2 -5 -8 -10 -10 -8 -5 -2  0  3  6  8 11 14 17 94 99 105
                        105 27 25 22 19 16 13 10  8  5  2  0 -3 -5 -5 -3  0  2  5  8 10 13 16 19 22 25 27 105
                           32 30 27 24 21 18 15 13 10  7  4  1 -1 -1  1  4  7 10 13 15 18 21 24 27 30 32
                              34 32 29 26 23 20 17 15 12  9  6  3  3  6  9 12 15 17 20 23 26 29 32 34
                                 36 34 31 28 25 22 20 17 14 11  8  8 11 14 17 20 22 25 28 31 34 36
                                    39 36 33 30 27 24 22 19 16 13 13 16 19 22 24 27 30 33 36 39
                                       41 38 35 32 29 26 24 21 18 18 21 24 26 29 32 35 38 41
                                          43 40 37 34 31 29 26 23 23 26 29 31 34 37 40 43
                                                39 36 33 31 28 28 31 33 36 39
```

Figure A10

Wavefront Plot – Q Polarization
1.25 Arc-Second Nominal Cube

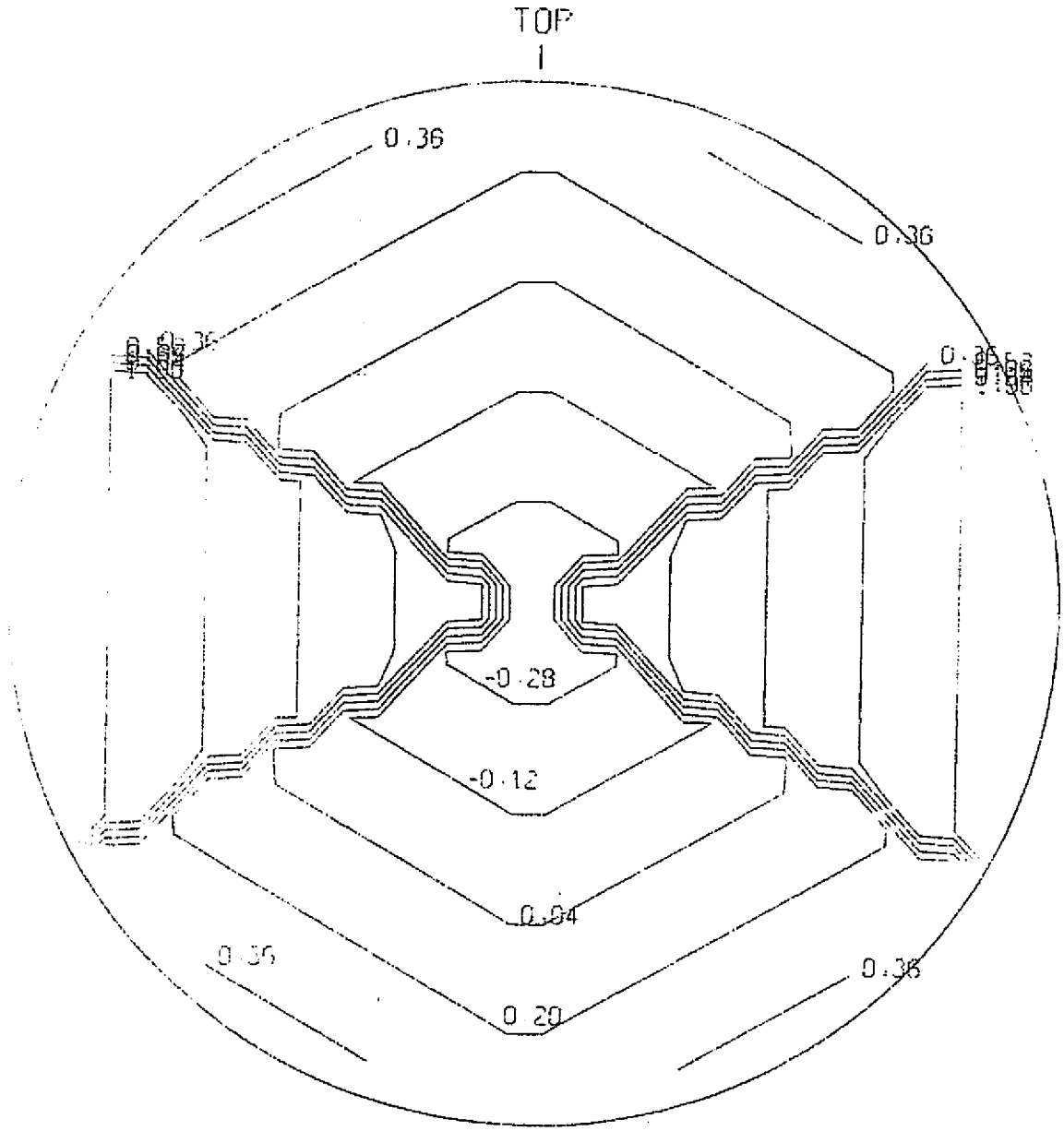


Figure 111

Wavefront Map - P Polarization

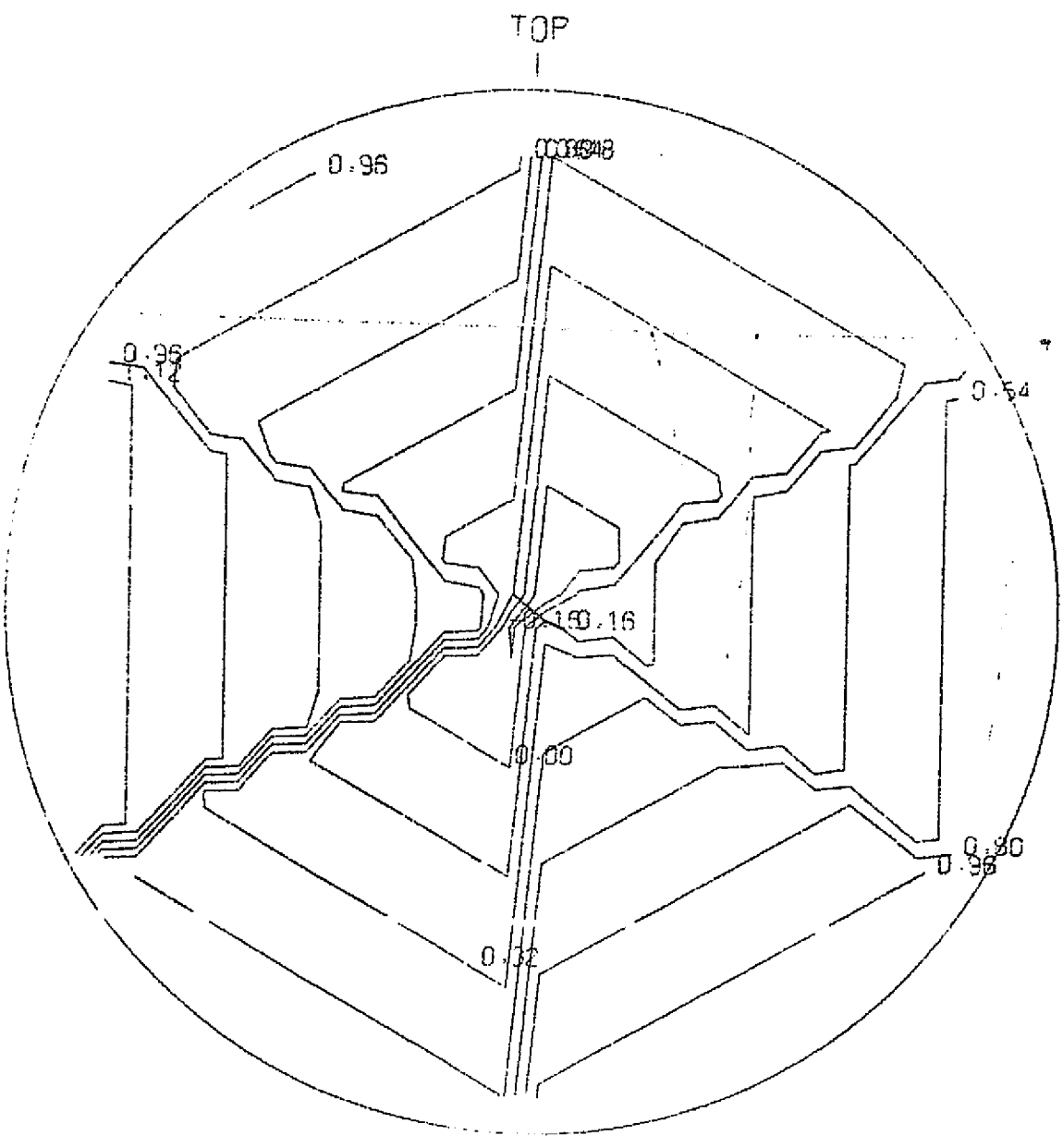
1.25 Arc-Second Nominal Cube

MAP IN UNITS OF 0.01 WAVES

									98	95	92	89	86	36	39	42	45	48												
							101	98	96	93	90	87	84	81	31	34	37	40	43	46	48	51								
						99	96	96	91	88	85	82	79	76	26	29	32	35	38	41	44	46	49							
					97	94	91	89	86	83	80	77	74	72	22	24	27	30	33	36	39	41	44	47						
				95	92	89	87	84	81	78	75	72	70	67	17	20	22	25	28	31	34	37	39	42	45					
			93	93	87	84	82	79	76	73	70	67	65	62	12	15	17	20	23	26	29	32	36	37	40	43				
		91	88	85	82	80	77	74	71	68	65	63	60	57	7	10	13	15	18	21	24	27	30	32	35	38	41			
	121	86	83	80	77	75	72	69	66	63	60	58	55	52	2	5	8	10	13	16	19	22	25	27	30	33	36	71		
	121	115	110	75	73	70	67	64	61	58	56	53	50	47	-2	3	3	6	8	11	14	17	20	23	25	60	65	71		
	121	115	110	104	68	65	62	59	56	54	51	48	65	42	-7	-4	-1	1	4	8	9	12	15	18	54	60	65	71		
127	121	115	110	104	98	93	57	54	51	49	46	43	40	37	-12	-9	-6	-3	0	1	4	7	43	48	56	60	65	71	77	
127	121	115	110	104	98	93	87	82	47	44	41	38	35	32	-17	-14	-11	-8	-5	-2	31	37	43	48	54	60	65	71	77	
127	121	115	110	104	98	93	87	81	76	70	38	33	30	27	-22	-19	-16	-13	20	26	31	37	43	48	54	60	65	71	77	
127	121	115	110	104	98	93	87	81	76	70	64	28	25	23	-26	-24	-21	14	20	26	31	37	43	48	54	60	65	71	77	
127	121	115	110	104	98	93	87	81	76	70	64	59	53	18	-31	3	9	14	20	26	31	37	43	48	54	60	65	71	77	
127	121	115	110	104	98	93	87	81	76	70	64	59	53	-20	29	3	9	14	20	26	31	37	43	48	54	60	65	71	77	
127	121	115	110	104	98	93	87	81	76	70	64	-9	-12	-15	34	37	40	14	20	26	31	37	43	48	54	60	65	71	77	
127	121	115	110	104	98	93	87	81	76	70	-1	-4	-7	-10	39	42	45	48	20	26	31	37	43	48	54	60	65	71	77	
127	121	115	110	104	98	93	87	82	8	5	2	0	-2	-5	-44	47	50	53	95	98	31	37	43	48	54	60	65	71	77	
127	121	115	110	104	98	93	19	16	13	10	7	5	2	0	49	52	55	57	60	63	68	69	43	48	54	60	45	71	77	
121	115	110	104	29	26	24	21	18	15	12	9	7	4	54	57	60	67	65	68	71	76	73	79	84	60	65	71			
121	115	110	37	34	31	29	26	23	20	17	14	12	9	59	62	64	67	70	73	76	78	81	84	87	60	65	72			
121	48	45	42	39	36	33	31	28	25	22	19	16	14	66	67	69	72	75	78	81	83	86	89	92	97	66	65			
	52	50	47	44	41	38	35	33	30	27	24	21	19	69	71	74	77	80	83	86	88	91	94	97	100	103				
		55	52	49	46	43	40	38	35	32	29	26	23	73	76	79	82	85	88	91	93	96	99	102	103					
			57	54	51	48	45	42	40	37	34	31	28	78	81	84	87	90	93	95	98	101	104	107						
				59	56	53	50	47	45	42	39	36	35	83	86	89	92	95	97	100	103	106	109							
					61	58	55	52	49	47	44	41	38	88	91	94	97	100	102	105	108	111								
						63	60	57	54	51	49	46	43	93	96	99	102	104	107	110	113									
									60	56	54	51	48	98	101	104	107	109												

Figure A12

Wavefront Plot - P Polarization
1.25 Arc-Second Nominal Cube



ORIGINAL PAGE IS
OF POOR QUALITY

Figure: A13

PRINTER MAP OF POINT SPREAD FUNCTION
1.25 Arc-Second Nominal Cube
(ONE SPACE REPRESENTS 0.04 MICRONS)
NORMALIZED SO LARGEST VALUE = 0.0392 = 100
TOTAL ENERGY = 0.2461000D+01
MAP REPRESENTS 0.2315001D+01 OR 94.0675 PERCENT OF TOTAL ENERGY

0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0
0	0	0	1	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	1	0	0	0
0	0	0	1	1	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	1	1	1	0	0	0	0	0	1	1	0	0	0
0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0
0	0	0	0	0	1	1	1	1	0	0	0	1	1	1	1	1	0	1	1	1	1	1	0	0	0	1	1	1	1	0	0	0	0	0
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0	1	0	0	0	1	1	1	1	1	3	6	22	42	51	62	85	100	85	62	51	42	22	6	3	1	1	1	1	1	0	0	0	1	0
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ID
ID

Figure. A14

Point Spread Function

1.25 Arc-Second Nominal Cube

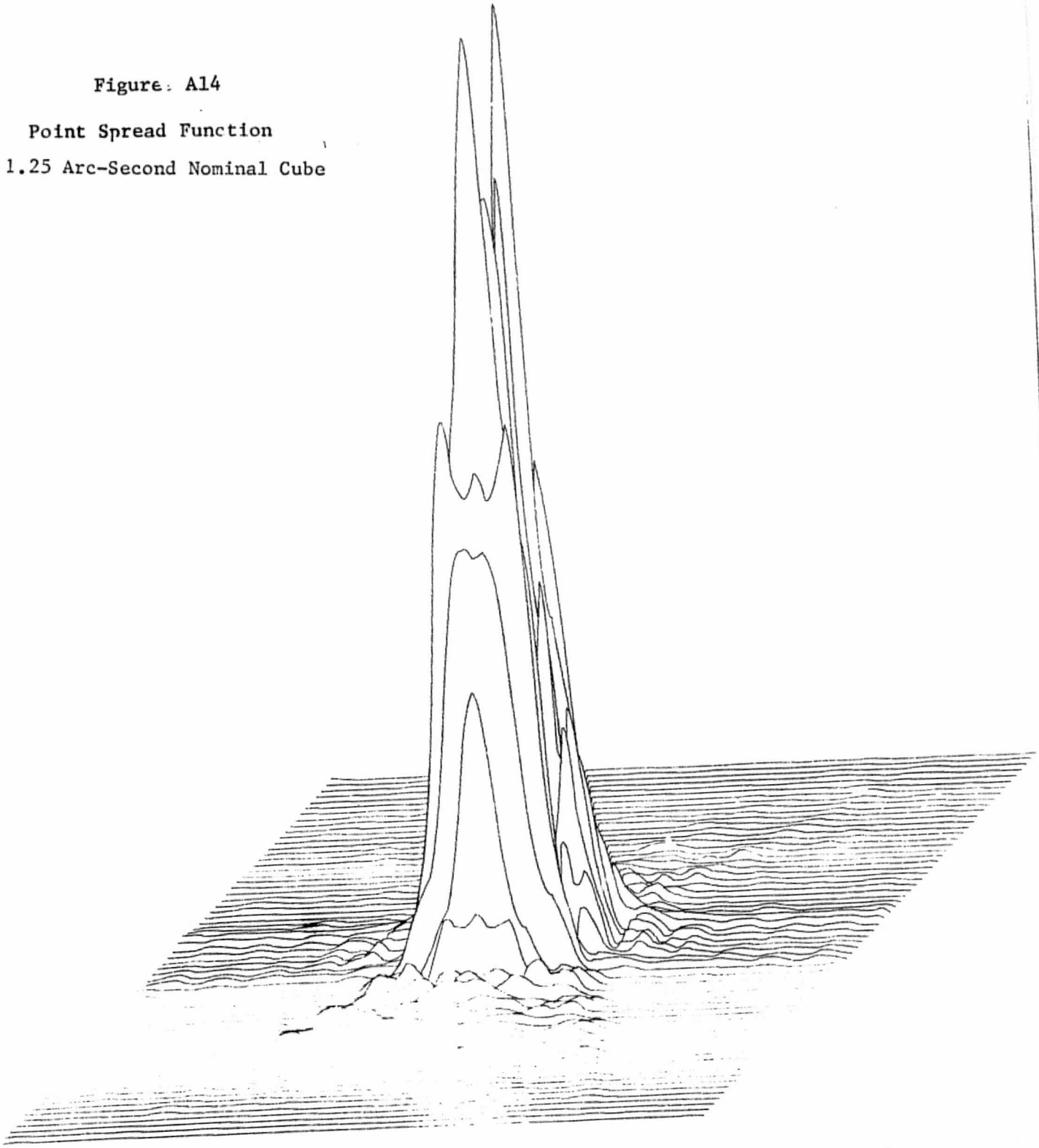
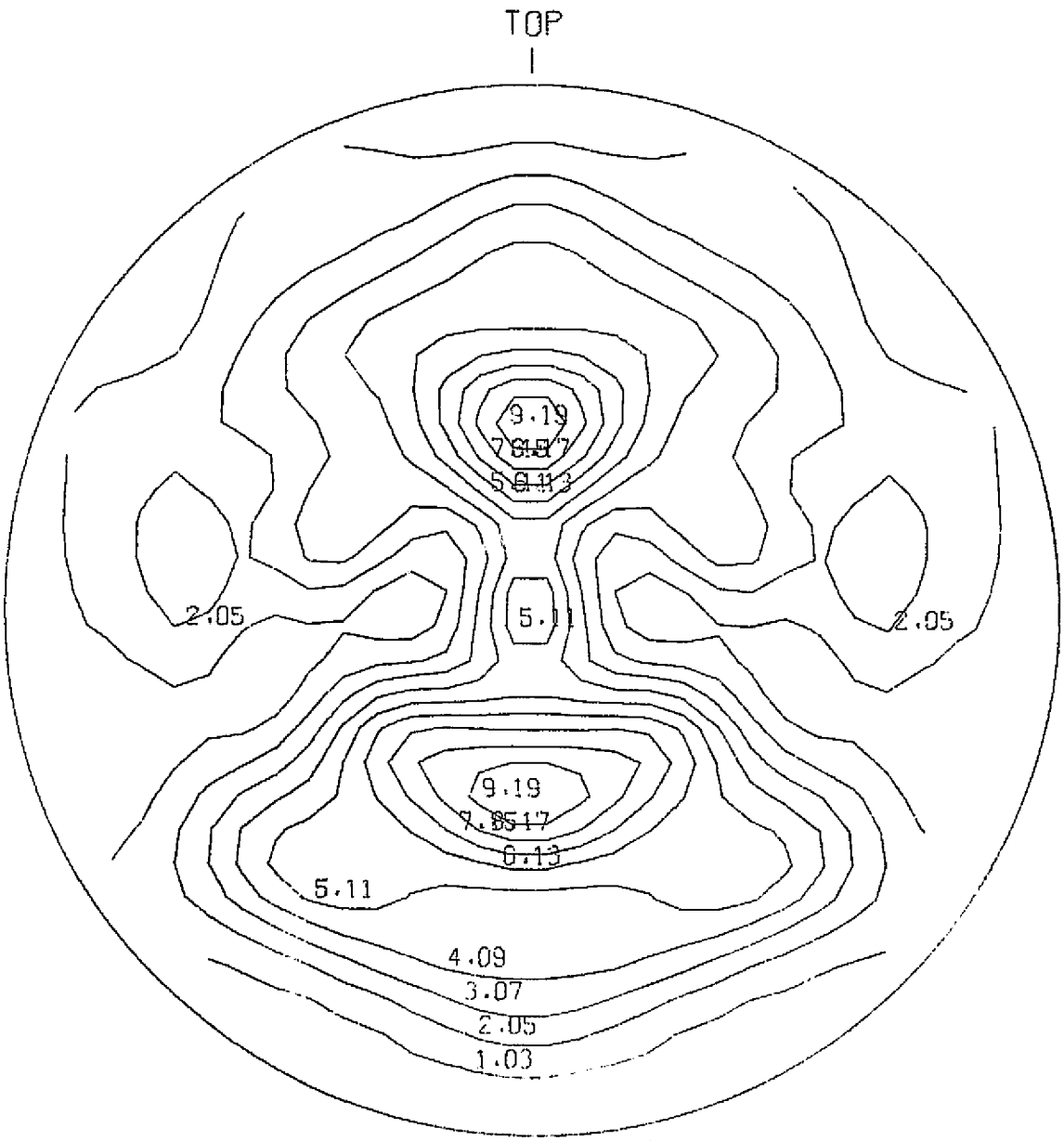


Figure A15

Intensity Distribution - Central 129 Microradians

1.25 Arc-Second Nominal Cube



46 1472

Figurer A16

Encircled Energy
Vs
Field Angle
1.25 Arc-Second Nominal Cube

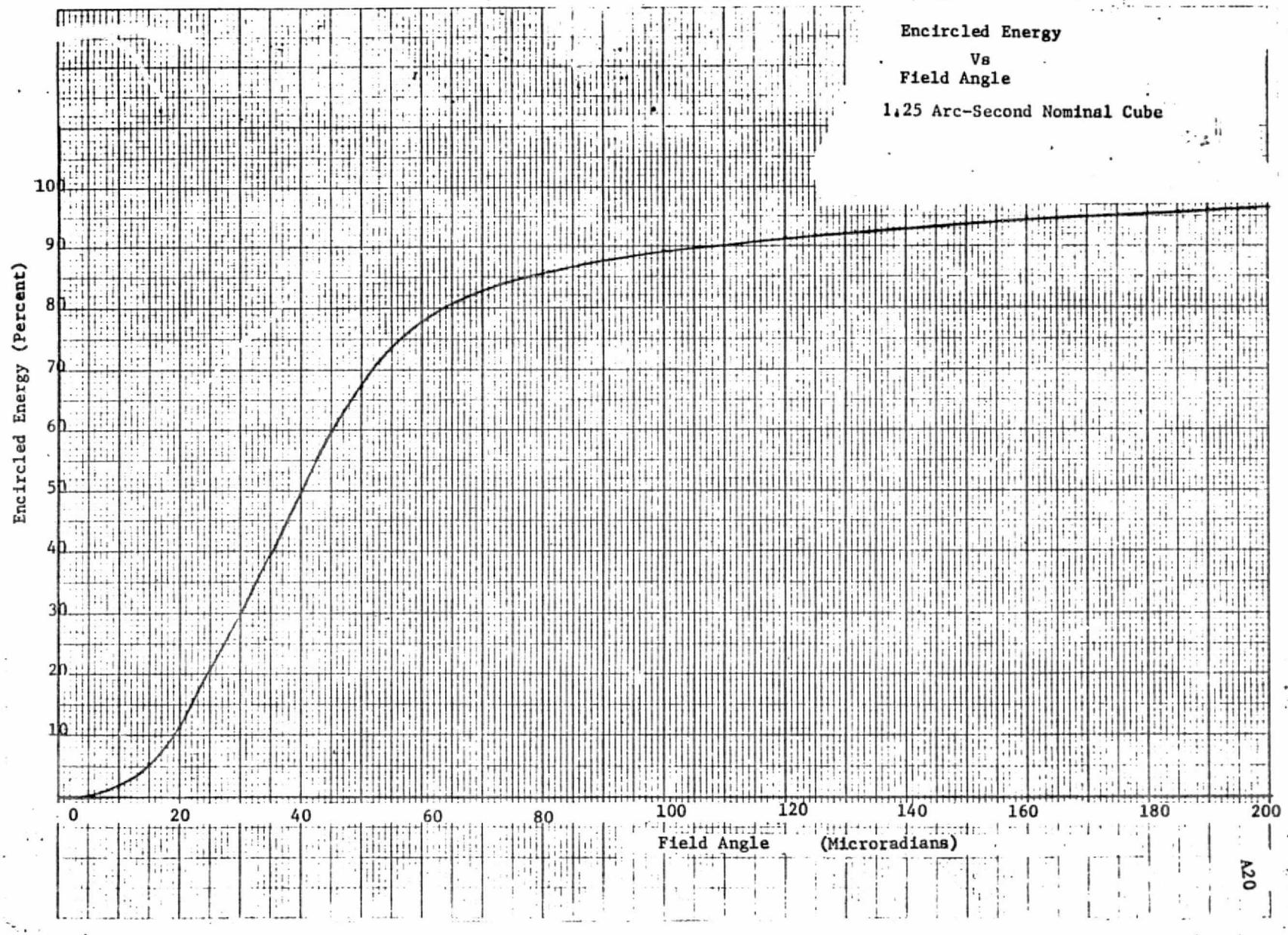


Table A4

ENCIRCLED ENERGY

1.25 Arc-Second Nominal Cube

CIRCLE RADIUS (MICRONS)	PERCENT ENERGY WITHIN CIRCLE CENTERED AT INDICATED COORDINATES								
	CENTER (MICRONS):								
	X= -10.13	10.13	0.0	-10.13	0.0	10.13	0.0	-10.13	10.13
	Y= -10.13	-10.13	-10.13	0.0	0.0	0.0	10.13	10.13	10.13
2.00	0.0	0.0	0.2	0.0	0.2	0.0	0.2	0.0	0.0
4.00	0.4	0.4	0.4	0.1	0.2	0.1	0.4	0.7	0.7
6.00	0.4	0.4	1.4	0.4	1.7	0.4	1.5	0.7	0.7
8.00	1.5	1.5	2.5	1.0	1.7	1.0	2.8	2.3	2.2
10.00	2.1	2.1	3.4	1.4	3.2	1.4	3.9	3.1	3.1
12.00	4.9	4.9	5.3	2.7	3.6	2.7	6.1	6.3	6.2
14.00	4.9	4.9	6.8	4.8	5.2	4.8	8.5	6.3	6.2
16.00	8.4	8.4	8.9	6.4	6.3	6.4	10.9	10.0	10.0
18.00	10.3	10.3	10.5	9.0	10.6	9.0	13.0	11.7	11.7
20.00	12.9	12.9	13.7	11.4	10.6	11.4	16.3	14.8	14.8
22.00	14.4	14.4	15.8	15.2	16.6	15.2	18.6	16.5	16.5
24.00	18.0	18.0	18.4	16.9	19.2	16.9	21.1	20.2	20.2
26.00	19.7	19.7	21.3	21.5	25.2	21.5	23.7	22.3	22.2
28.00	24.0	24.0	25.9	25.9	26.8	25.9	28.4	26.5	26.5
30.00	26.9	26.9	28.7	30.1	32.4	30.1	30.7	29.8	29.8
32.00	32.7	32.7	33.1	33.4	35.0	33.3	35.3	35.4	35.4
34.00	33.9	33.9	36.5	38.5	38.8	38.5	38.8	36.7	36.6
36.00	39.9	39.9	41.0	42.0	42.8	42.0	43.7	42.3	42.3
38.00	42.6	42.6	44.3	46.2	47.8	46.2	46.8	45.1	45.1
40.00	47.2	47.2	48.3	49.7	50.4	49.7	51.2	49.5	49.5
42.00	49.6	49.6	52.0	54.4	56.2	54.4	54.6	51.8	51.3
44.00	54.0	54.0	54.9	56.5	59.4	56.5	57.8	56.0	56.0
46.00	56.8	56.8	58.4	61.1	64.7	61.1	60.9	58.8	58.8
48.00	60.3	60.3	62.2	64.3	66.0	64.3	64.3	62.2	62.2
50.00	63.1	63.1	64.6	67.0	70.2	67.0	66.2	64.8	64.8
52.00	66.3	66.3	68.0	69.8	71.9	69.8	69.2	67.6	67.6
54.00	68.1	68.1	70.6	72.3	74.4	72.3	71.1	69.3	69.3
56.00	71.4	71.4	73.8	74.8	75.8	74.8	73.8	72.0	72.0
58.00	73.5	73.5	75.3	76.1	77.7	76.1	75.3	73.8	73.8
60.00	75.5	75.5	77.4	77.8	79.0	77.8	77.1	75.6	75.6
62.00	77.0	77.0	78.8	78.9	80.2	78.9	78.4	76.9	76.9
64.00	78.9	78.9	79.8	79.8	81.2	79.8	79.7	78.6	78.6
66.00	79.9	79.9	81.0	80.8	82.1	80.8	80.9	79.7	79.7
68.00	81.1	81.1	81.9	81.6	82.5	81.6	81.8	81.0	81.0
70.00	81.8	81.8	82.6	82.3	83.1	82.3	82.7	81.7	81.7
72.00	82.7	82.7	83.2	83.0	83.5	83.0	83.3	82.8	82.8
74.00	83.2	83.2	83.9	83.6	84.0	83.6	84.0	83.3	83.3
76.00	84.0	84.0	84.4	84.2	84.3	84.2	84.5	84.1	84.1
78.00	84.5	84.5	84.7	84.7	84.8	84.7	84.8	84.6	84.6
80.00	85.0	85.0	85.1	85.2	85.2	85.2	85.3	85.2	85.2

Table A5

ENCIRCLED ENERGY

1.25 Arc-Second Nominal Cube

CIRCLE RADIUS (MICRONS)	PERCENT ENERGY WITHIN CIRCLE CENTERED AT INDICATED COORDINATES								
CENTER (MICRONS): X=	-10.13	10.13	0.0	-10.13	0.0	10.13	0.0	-10.13	10.13
Y=	-10.13	-10.13	-10.13	0.0	0.0	0.0	10.13	10.13	10.13
5.00	0.4	0.4	1.1	0.3	1.1	0.3	1.2	0.7	0.7
10.00	2.1	2.1	3.4	1.4	3.2	1.4	3.9	3.1	3.1
15.00	7.0	7.0	8.5	5.6	6.3	5.6	10.2	8.5	8.4
20.00	12.9	12.9	13.7	11.4	10.6	11.4	16.3	14.8	14.8
25.00	19.2	19.1	20.4	21.0	21.9	21.0	23.0	21.6	21.6
30.00	26.9	26.9	28.7	30.1	32.4	30.1	30.7	29.8	29.8
35.00	37.6	37.6	38.9	39.5	41.7	39.5	41.1	39.9	39.9
40.00	47.2	47.2	48.3	49.7	50.4	49.7	51.2	49.5	49.5
45.00	55.6	55.5	56.9	59.6	62.4	59.6	59.5	57.6	57.5
50.00	63.1	63.1	64.6	67.0	70.2	67.0	66.2	64.8	64.8
55.00	70.2	70.2	72.4	73.6	75.5	73.6	72.8	70.9	70.9
60.00	75.5	75.5	77.4	77.8	79.0	77.8	77.1	75.6	75.6
65.00	79.3	79.3	80.6	80.4	81.8	80.4	80.4	79.2	79.2
70.00	81.8	81.8	82.6	82.3	83.1	82.3	82.7	81.7	81.7
75.00	83.6	83.6	84.1	84.0	84.1	84.0	84.3	83.8	83.8
80.00	85.0	85.0	85.1	85.2	85.2	85.2	85.3	85.2	85.2
85.00	86.0	86.0	86.1	86.4	86.4	86.4	86.3	86.2	86.2
90.00	87.0	87.0	87.2	87.4	87.4	87.4	87.3	87.1	87.1
95.00	88.0	88.0	88.1	88.2	88.4	88.2	88.2	88.1	88.1
100.00	88.8	88.8	89.0	89.0	89.2	89.0	89.0	88.8	88.8
105.00	89.5	89.5	89.7	89.6	89.8	89.6	89.7	89.5	89.5
110.00	90.1	90.2	90.3	90.2	90.3	90.2	90.3	90.2	90.2
115.00	90.7	90.7	90.7	90.7	90.8	90.7	90.7	90.8	90.8
120.00	91.2	91.2	91.1	91.3	91.2	91.3	91.2	91.3	91.3
125.00	91.6	91.6	91.6	91.7	91.7	91.7	91.7	91.7	91.7
130.00	92.0	92.0	92.1	92.1	92.2	92.1	92.2	92.1	92.1
135.00	92.5	92.5	92.5	92.5	92.6	92.5	92.5	92.5	92.5
140.00	92.9	92.9	92.9	92.9	92.9	92.9	93.0	92.9	92.9
145.00	93.2	93.2	93.2	93.2	93.2	93.2	93.2	93.2	93.2
150.00	93.5	93.5	93.5	93.5	93.6	93.5	93.5	93.5	93.5
155.00	93.9	93.9	93.8	93.9	93.9	93.9	93.8	93.8	93.8
160.00	94.2	94.2	94.2	94.2	94.1	94.2	94.1	94.2	94.2
165.00	94.5	94.5	94.5	94.5	94.5	94.5	94.5	94.5	94.5
170.00	94.7	94.7	94.8	94.8	94.9	94.8	94.8	94.8	94.8
175.00	95.0	95.0	95.1	95.1	95.1	95.1	95.1	95.0	95.0
180.00	95.3	95.3	95.3	95.3	95.4	95.3	95.3	95.3	95.3
184.99	95.5	95.5	95.5	95.6	95.5	95.6	95.5	95.6	95.6
189.99	95.8	95.8	95.8	95.8	95.8	95.8	95.8	95.8	95.8
194.99	96.0	96.0	96.0	96.0	96.1	96.0	96.0	96.0	96.0
199.99	96.3	96.3	96.2	96.3	96.3	96.3	96.2	96.3	96.3

Figure A17

Wavefront Map - Q Polarization

1.75 Arc Second Nominal Cube

MAP IN UNITS OF 0.01 WAVES

```
                                                73 69 65 61 57 57 61 65 69 73
                                          78 74 70 66 62 58 54 50 50 54 58 62 66 70 74 78
                                       75 71 67 63 59 55 51 47 43 43 47 51 55 59 63 67 71 75
                                    72 68 64 60 56 52 48 44 40 36 36 40 44 48 52 56 60 64 68 72
                                 69 65 61 57 53 49 45 41 37 33 29 29 33 37 41 45 49 53 57 61 65 69
                              66 62 58 54 50 46 42 38 34 30 26 22 22 26 30 34 38 42 46 50 54 58 62 66
                           63 59 55 51 47 43 39 35 31 28 24 20 16 16 20 24 28 31 35 39 43 47 51 55 59 63
                        136 56 52 48 44 40 36 33 29 25 21 17 13 9 9 13 17 21 25 29 33 36 40 44 48 52 56 136
                     136 128 120 42 38 34 30 26 22 18 14 10 6 2 2 6 10 14 18 22 26 30 34 38 42 120 128 136
                  136 128 120 112 31 27 23 19 15 11 7 3 0 -4 -4 0 3 7 11 15 19 23 27 31 112 120 128 136
               144 136 128 120 112 104 96 16 12 8 4 0 -3 -7 -11 -11 -7 -3 0 4 8 12 16 96 104 112 120 128 136 144
               144 136 128 120 112 104 96 88 80 1 -2 -6 -10 -14 -18 -18 -14 -10 -6 -2 1 80 88 96 104 112 120 128 136 144
               144 136 128 120 112 104 96 88 80 72 64 -13 -17 -21 -25 -25 -21 -17 -13 64 72 80 88 96 104 112 120 128 136 144
               144 136 128 120 112 104 96 88 80 72 64 56 -24 -27 -31 -31 -27 -24 56 64 72 80 88 96 104 112 120 128 136 144
               144 136 128 120 112 104 96 88 80 72 64 56 48 41 -38 -38 41 48 56 64 72 80 88 96 104 112 120 128 136 144
               144 136 128 120 112 104 96 88 80 72 64 56 48 41 -38 -38 41 48 56 64 72 80 88 96 104 112 120 128 136 144
               144 136 128 120 112 104 96 88 80 72 64 56 -24 -27 -31 -31 -27 -24 56 64 72 80 88 96 104 112 120 128 136 144
               144 136 128 120 112 104 96 88 80 72 64 -13 -17 -21 -25 -25 -21 -17 -13 64 72 80 88 96 104 112 120 128 136 144
               144 136 128 120 112 104 96 88 80 1 -2 -6 -10 -14 -18 -18 -14 -10 -6 -2 1 80 88 96 104 112 120 128 136 144
               144 136 128 120 112 104 96 16 12 8 4 0 -3 -7 -11 -11 -7 -3 0 4 8 12 16 96 104 112 120 128 136 144
                  136 128 120 112 31 27 23 19 15 11 7 3 0 -4 -4 0 3 7 11 15 19 23 27 31 112 120 128 136
                     136 128 120 42 38 34 30 26 22 18 14 10 6 2 2 6 10 14 18 22 26 30 34 38 42 120 128 136
                        136 56 52 48 44 40 36 33 29 25 21 17 13 9 9 13 17 21 25 29 33 36 40 44 48 52 56 136
                           63 59 55 51 47 43 39 35 31 28 24 20 16 16 20 24 28 31 35 39 43 47 51 55 59 63
                              66 62 58 54 50 46 42 38 34 30 26 22 22 26 30 34 38 42 46 50 54 58 62 66
                                 69 65 61 57 53 49 45 41 37 33 29 29 33 37 41 45 49 53 57 61 65 69
                                    72 68 64 60 56 52 48 44 40 36 36 40 44 48 52 56 60 64 68 72
                                       75 71 67 63 59 55 51 47 43 43 47 51 55 59 63 67 71 75
                                          78 74 70 66 62 58 54 50 50 54 58 62 66 70 74 78
                                                73 69 65 61 57 57 61 65 69 73
```

Figure A18

Wavefront Plot - Q Polarization

1.75 Arc Second Nominal Cube

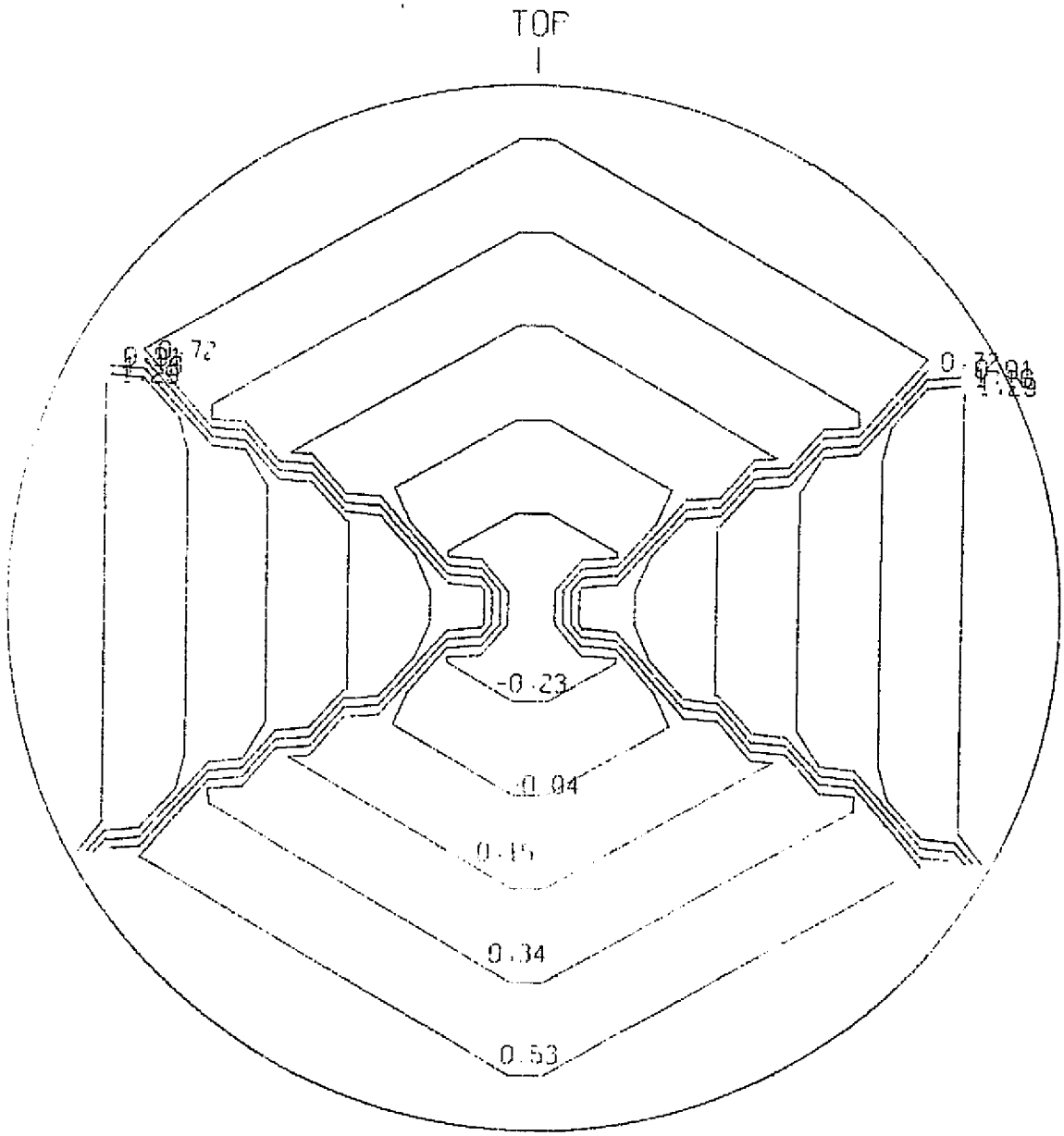


Figure A19

Wavefront Map - P Polarization

1.75 Arc Second Nominal Cube

MAP IN UNITS OF 0.01 WAVES

131 127 123 119 115 65 69 73 77 81

136 132 128 124 120 116 112 108 58 62 66 70 74 78 82 86

133 129 125 121 117 113 110 106 102 52 56 60 63 67 71 75 79 83

130 126 122 118 115 111 107 103 99 95 45 49 53 57 61 65 68 72 76 80

127 124 120 116 112 108 104 100 96 92 88 38 42 46 50 54 58 62 66 70 74 77

125 121 117 113 109 105 101 97 93 89 85 81 31 35 39 43 47 51 55 59 63 67 71 75

122 118 114 110 106 102 98 94 90 86 82 78 74 24 28 32 36 40 44 48 52 56 60 64 68 72

152 115 111 107 103 99 95 91 87 83 79 75 71 67 17 21 25 29 33 37 41 45 49 53 57 61 65 102

152 144 136 100 96 92 88 84 80 76 72 68 64 60 10 14 18 22 26 30 34 38 42 46 50 86 94 102

152 144 136 128 89 85 81 77 73 69 65 61 57 54 4 7 11 15 19 23 27 31 35 39 78 86 94 102

160 152 144 136 128 120 112 74 70 66 63 59 55 51 47 -2 1 5 9 13 16 20 24 62 70 78 86 94 102 110

160 152 144 136 128 120 112 104 96 60 56 52 48 44 40 -9 -5 -1 2 6 10 46 54 62 70 78 86 94 102 110

160 152 144 136 128 120 112 104 96 88 80 45 41 37 33 -16 -12 -8 -4 30 38 46 54 62 70 78 86 94 102 110

160 152 144 136 128 120 112 104 96 88 80 72 34 30 26 -23 -19 -15 22 30 38 46 54 62 70 78 86 94 102 110

160 152 144 136 128 120 112 104 96 88 80 72 64 57 19 -30 7 14 22 30 38 46 54 62 70 78 86 94 102 110

160 152 144 136 128 120 112 104 96 88 80 72 64 57 -18 31 7 14 22 30 38 46 54 62 70 78 86 94 102 110

160 152 144 136 128 120 112 104 96 88 80 72 -3 -7 -11 38 42 46 22 30 38 46 54 62 70 78 86 94 102 110

160 152 144 136 128 120 112 104 96 88 80 6 2 -1 -4 45 49 53 57 30 38 46 54 62 70 78 86 94 102 110

160 152 144 136 128 120 112 104 96 21 17 13 9 5 1 52 56 59 63 67 71 46 54 62 70 78 86 94 102 110

163 152 144 136 128 120 112 36 32 28 24 20 16 12 8 58 62 66 70 74 78 82 86 62 70 78 86 94 102 110

152 144 136 128 51 47 43 39 35 31 27 23 19 15 65 69 73 77 81 85 89 93 97 101 78 86 94 102

152 144 136 62 58 54 50 46 42 38 34 30 26 22 72 76 80 84 88 92 96 100 104 108 112 86 94 102

152 76 72 68 65 61 57 53 49 45 41 37 33 29 79 83 87 91 95 99 103 107 111 115 119 123 127 102

83 79 75 71 67 63 59 56 52 48 44 40 36 86 90 94 98 102 106 110 114 118 122 126 129 133

86 82 78 74 70 66 62 58 54 50 47 43 93 97 101 105 109 113 117 120 124 128 132 136

89 85 81 77 73 69 65 61 57 53 49 100 104 108 111 115 119 123 127 131 135 139

92 88 84 80 76 72 68 64 60 56 106 110 114 118 122 126 130 134 138 142

95 91 87 83 79 75 71 67 63 113 117 121 125 129 133 137 141 145

98 94 90 86 82 78 74 70 120 124 128 132 136 140 144 148

93 89 85 81 77 127 131 135 139 143

Figure A20

Wavefront Plot - P Polarization

1.75 Arc Second Nominal Cube

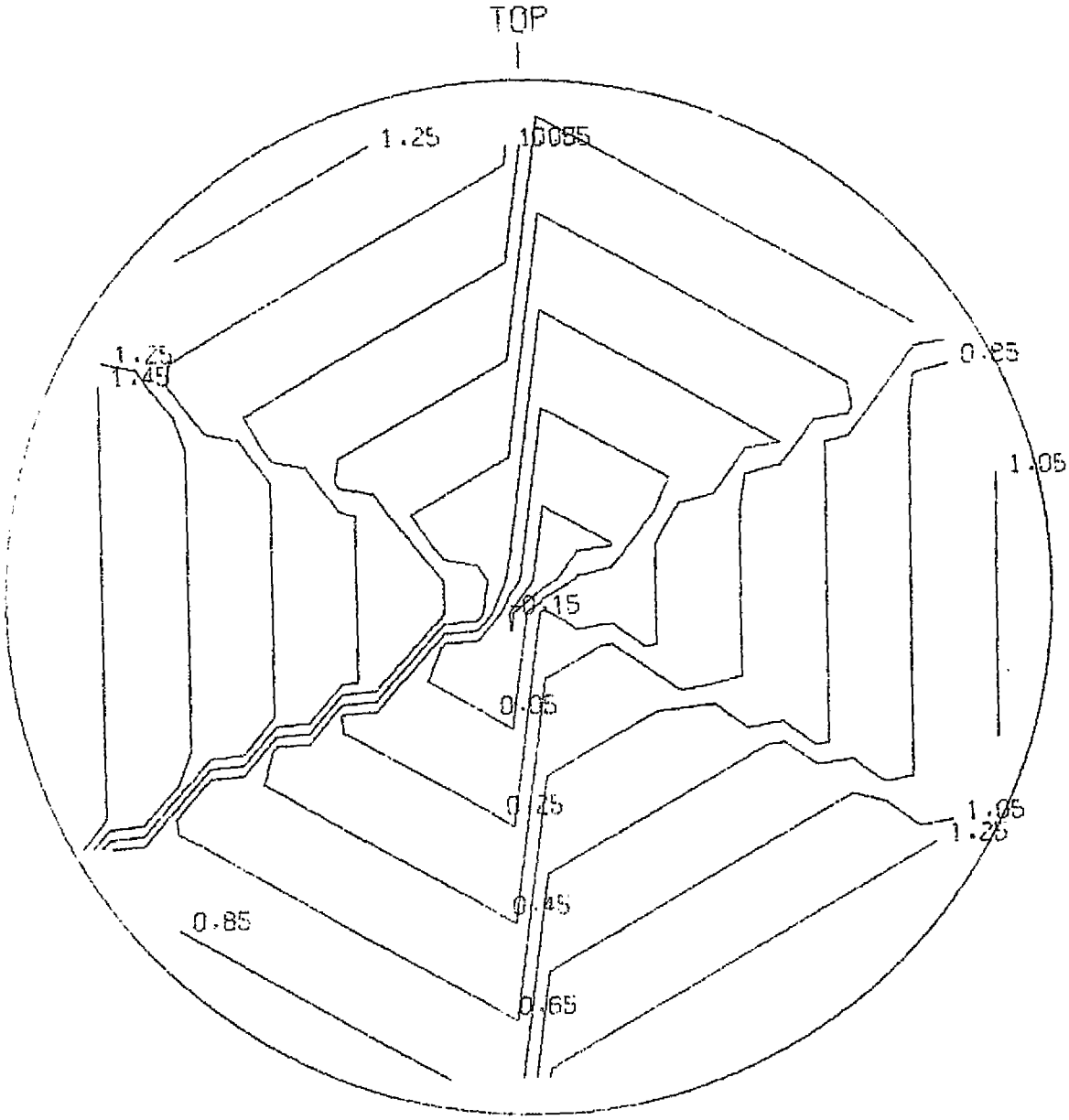


Figure A21

PRINTER MAP OF POINT SPREAD FUNCTION
1.75 Arc Second Nominal Cube
(ONE SPACE REPRESENTS 8.04 MICRONS)
NORMALIZED SO LARGEST VALUE = 0.0234 = 100
TOTAL ENERGY = 0.2461000D+01
MAP REPRESENTS 0.2312441D+01 OR 93.9635 PERCENT OF TOTAL ENERGY

```
 0  1  1  1  0  0  0  0  0  0  1  1  2  1  1  1  0  0  0  1  1  1  2  1  1  0  0  0  0  0  0  1  1  1  0
 0  1  1  1  1  0  0  0  0  0  1  1  1  1  2  2  1  0  1  2  2  1  1  1  1  0  0  0  0  0  1  1  1  1  0
 0  0  1  1  1  0  0  1  0  0  1  1  1  1  1  1  1  0  0  0  1  1  1  1  1  1  0  0  1  0  0  1  1  1  0  0
 0  0  0  1  0  0  1  0  1  1  0  1  1  1  1  2  2  2  2  2  2  2  2  1  1  1  1  0  0  1  1  1  0  0  0  0
 0  0  0  1  1  1  1  1  0  1  1  1  1  1  1  3  5  8  5  3  1  1  1  1  1  1  0  1  1  1  1  1  1  0  0  0
 0  0  0  1  1  1  1  0  1  2  1  1  2  1  1  2  4  6  4  2  1  1  2  1  1  2  1  0  1  1  1  1  0  0  0  0
 0  0  0  0  1  1  1  1  1  1  2  4  2  1  3  3  3  4  3  3  3  1  2  4  2  1  1  1  1  1  1  0  0  0  0  0
 0  0  0  0  0  1  1  1  1  1  2  2  2  4  5  6  6  6  6  6  5  4  2  2  2  1  1  1  1  1  0  0  0  0  0  0
 0  0  0  0  0  1  1  1  3  2  1  4  7  9 11 14 15 14 15 14 11  9  7  4  1  2  3  1  1  1  0  0  0  0  0  0
 0  0  0  0  0  1  2  2  2  1  2  6  9 17 32 33 27 26 27 33 32 17  9  6  2  1  2  2  2  1  0  0  0  0  0  0
 1  1  1  1  1  2  4  4  3  2  4 10 23 42 53 40 53 63 53 48 53 42 23 10  4  2  3  4  4  2  1  1  1  1  1  1
 1  1  1  0  1  2  4  5  4  3  8 18 33 50 57 64 79 87 79 64 57 50 33 18  8  3  4  5  4  2  1  0  1  1  1  1
 1  1  1  1  2  2  2  3  6  9 18 22 28 50 69 73 63 54 63 73 69 50 28 22 18  9  6  3  2  2  2  1  1  1  1  1
 1  1  1  2  2  2  1  3  7 13 23 25 30 46 58 56 54 59 54 56 58 46 30 25 23 13  7  3  1  2  2  2  1  1  1  1
 0  0  1  1  1  2  1  3  6 14 22 26 30 23 38 41 35 46 35 41 38 23 30 26 22 14  6  3  1  2  1  1  1  0  0  0
 0  1  1  2  1  2  1  4  6 16 23 28 35 18 38 34  5 15  5 33 38 18 35 28 23 16  6  4  1  2  1  2  1  1  0  0
 1  1  1  2  1  2  1  4  6 18 26 26 37 16 19 14  5 28  5 14 19 16 37 26 26 18  6  4  1  2  1  2  1  1  1  1
 1  1  0  2  2  2  0  3  7 19 26 15 19  7 17 32 17 15 17 32 17  7 19 15 26 19  7  3  0  2  2  2  0  1  1  1
 0  0  0  2  2  1  0  3  7 12 15  6 14 24 40 62 56 46 55 62 40 24 14  6 15 12  7  3  0  1  2  2  0  0  0  0
 0  0  1  1  1  1  1  3  4  3  9 15 36 68 74 61 57 59 57 61 74 68 36 15  9  3  4  3  1  1  1  1  1  0  0  0
 1  1  1  1  2  2  2  2  3 17 35 52 81100 86 63 54 62 86100 81 52 35 17  3  2  2  2  2  2  1  1  1  1  1
 1  0  1  1  1  1  1  2  3  5 16 32 45 55 69 83 88 87 88 83 69 55 45 32 16  5  3  2  1  1  1  1  1  0  1  1
 1  0  1  1  0  1  2  5  6  5  5 12 28 44 49 50 57 63 57 50 49 44 28 12  5  5  6  5  2  1  0  1  1  0  1  1
 0  0  1  1  0  1  2  5  6  2  0  2 10 26 39 36 28 26 28 36 39 26 10  2  0  2  6  5  2  1  0  1  1  0  0  0
 0  0  0  0  0  1  2  2  4  3  1  3  6  7 12 15 14 14 14 15 12  7  6  3  1  3  4  2  2  1  0  0  0  0  0  0
 0  0  0  0  0  1  1  1  2  4  3  2  3  3  2  3  5  6  5  3  2  3  3  2  3  4  2  1  1  1  0  0  0  0  0  0
 0  0  0  0  1  1  1  0  1  1  3  3  1  1  2  4  4  4  4  4  2  1  1  3  3  1  1  0  1  1  1  0  0  0  0  0
 0  0  0  1  1  2  2  1  0  1  1  2  3  2  2  4  5  6  5  4  2  2  3  2  1  1  0  1  2  2  1  1  0  0  0  0
 0  0  0  1  2  2  2  2  0  1  1  1  1  1  1  1  2  5  8  5  2  1  1  1  1  1  1  0  2  2  2  1  1  0  0  0
 0  0  0  1  1  1  1  1  1  1  1  1  1  1  1  2  2  2  2  2  1  1  1  1  1  1  1  1  1  1  1  1  0  0  0  0
 0  0  0  1  0  0  0  0  1  1  1  1  1  2  1  1  1  0  1  1  1  2  1  1  1  1  1  0  0  0  0  1  0  0  0  0
 0  1  1  1  1  0  0  0  0  0  1  1  1  2  2  1  1  0  0  0  1  1  2  2  1  1  1  0  0  0  0  1  1  1  1  0
 0  1  1  1  1  1  0  0  0  0  0  0  1  1  1  2  2  1  0  1  2  2  1  1  1  1  0  0  0  0  0  1  1  1  1  0
 0  0  1  1  0  0  0  0  0  0  0  1  1  1  1  1  0  0  0  1  1  1  1  1  0  0  0  0  0  0  0  1  1  0  0
```

Figure A22

Point Spread Function

1.75 Arc Second Nominal Cube

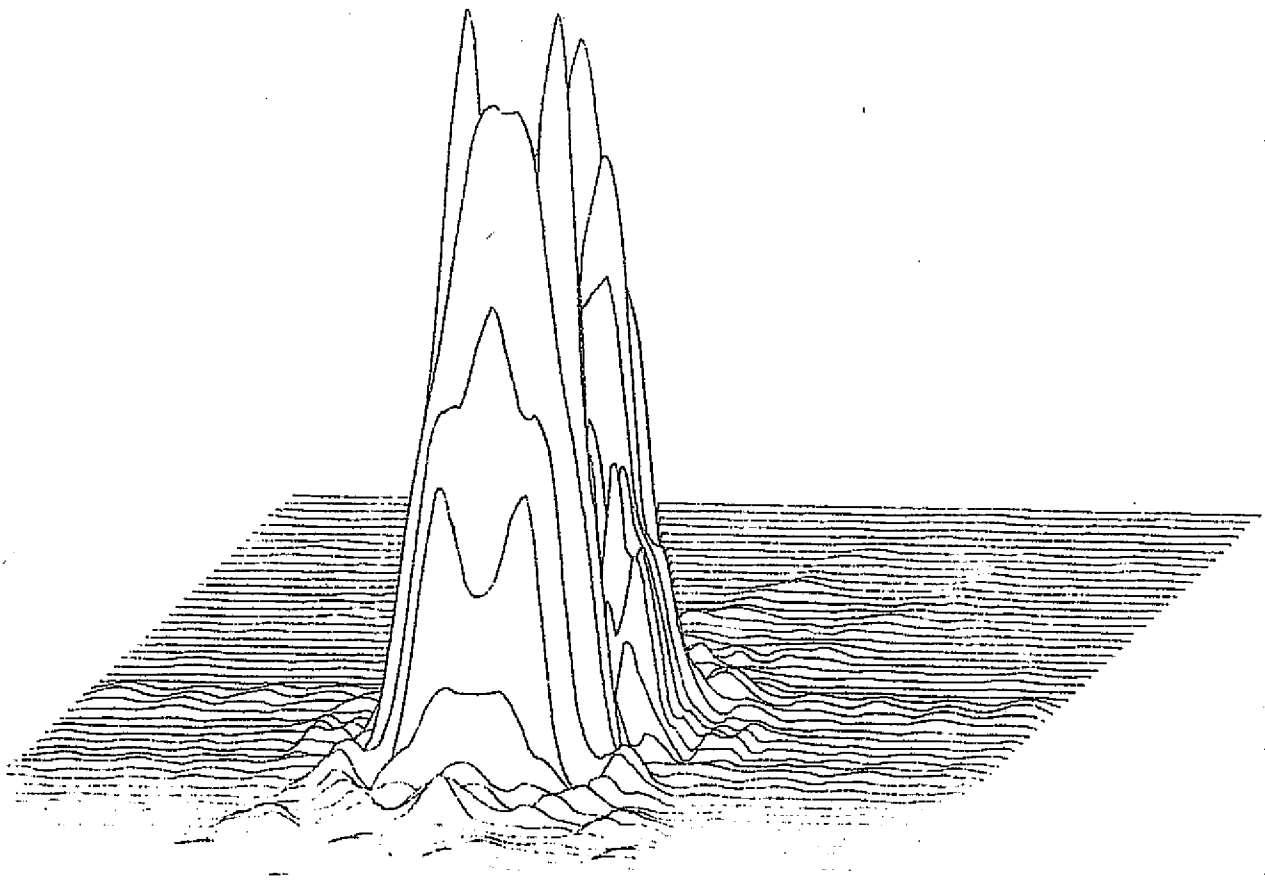


Figure A23

Intensity Distribution - Central 129 Microradians

1.75 Arc Second Nominal Cube

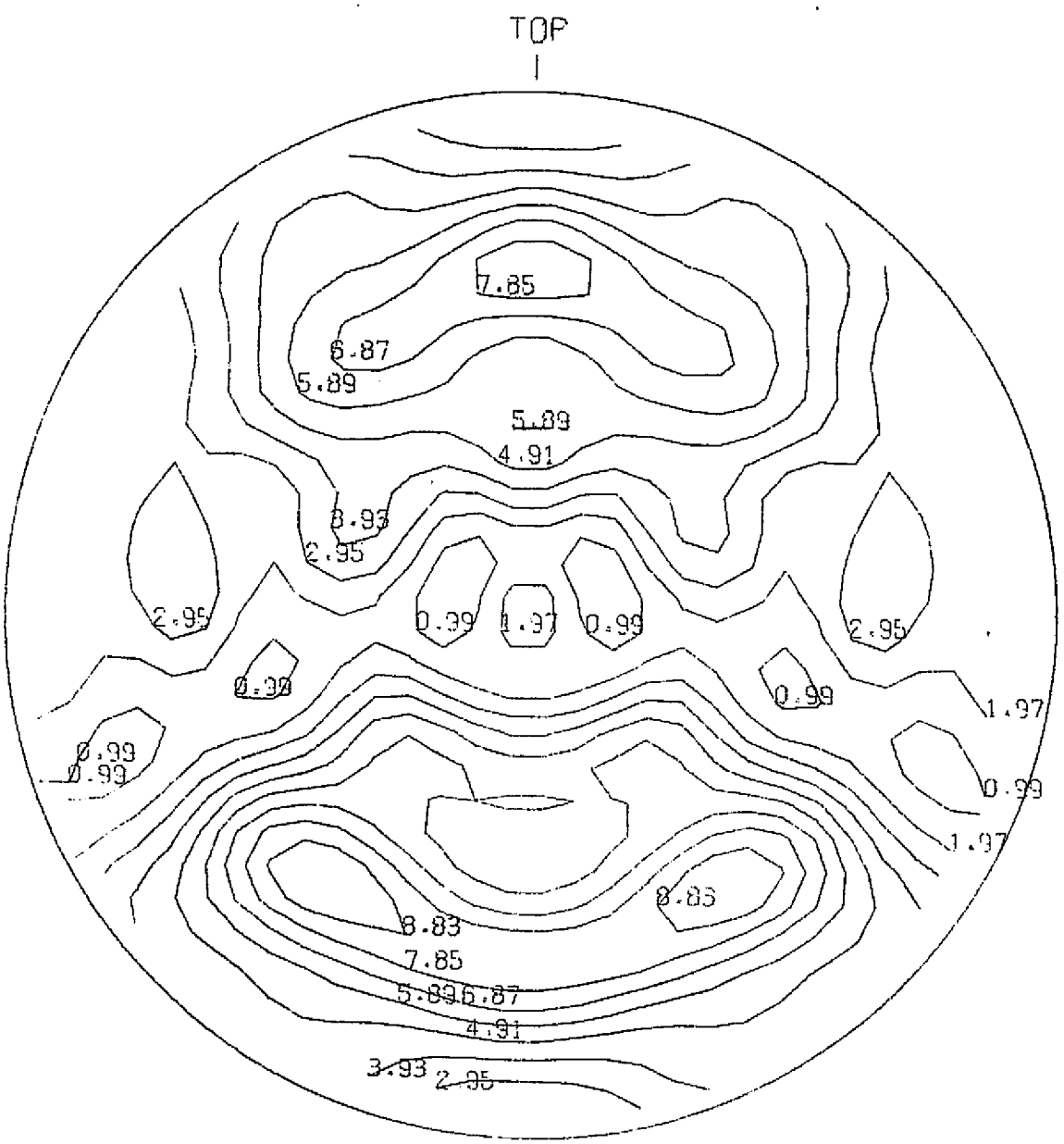


Figure A24

Encircled Energy

Vs

Field Angle

1.75 Arc Second Nominal Cube

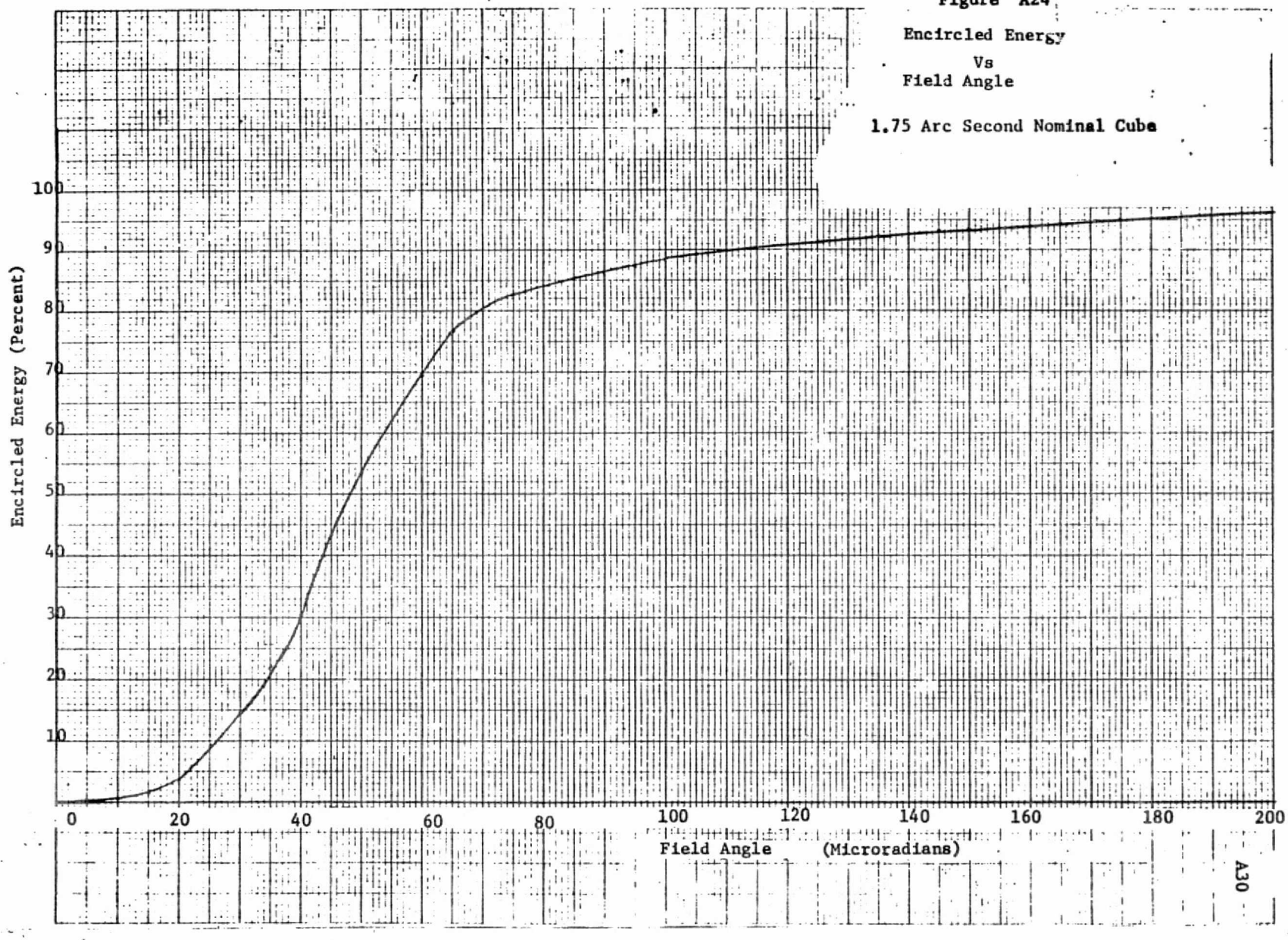


Table A6

ENCIRCLED ENERGY

1.75 Arc Second Nominal Cube

CIRCLE RADIUS (MICRONS)	PERCENT ENERGY WITHIN CIRCLE CENTERED AT INDICATED COORDINATES								
CENTER (MICRONS): X=	-10.13	10.13	0.0	-10.13	0.0	10.13	0.0	-10.13	10.13
Y=	-10.13	-10.13	-10.13	0.0	0.0	0.0	10.13	10.13	10.13
2.00	0.0	0.0	0.1	0.0	0.1	0.0	0.1	0.0	0.0
4.00	0.2	0.2	0.1	0.0	0.1	0.0	0.1	0.3	0.3
6.00	0.2	0.2	0.4	0.1	0.4	0.1	0.4	0.3	0.3
8.00	0.6	0.6	0.7	0.3	0.4	0.3	0.8	0.9	0.9
10.00	0.9	0.9	0.9	0.5	0.6	0.5	1.2	1.3	1.3
12.00	2.1	2.1	1.5	1.0	0.8	1.0	1.9	2.5	2.5
14.00	2.1	2.1	2.2	1.9	1.3	1.9	2.9	2.5	2.5
16.00	3.6	3.6	3.0	2.5	1.7	2.5	3.8	4.1	4.1
18.00	4.3	4.3	3.9	3.6	3.7	3.6	4.8	4.9	4.9
20.00	5.8	5.8	5.4	4.6	3.7	4.6	6.2	6.4	6.4
22.00	6.5	6.5	6.9	6.3	6.6	6.3	7.7	7.2	7.2
24.00	8.6	8.6	8.3	7.1	8.0	7.1	9.0	9.4	9.4
26.00	9.6	9.6	10.3	9.3	10.9	9.3	10.9	10.7	10.7
28.00	12.6	12.6	13.5	11.9	11.7	11.9	14.3	13.8	13.8
30.00	14.6	14.6	15.4	14.4	14.8	14.4	16.2	16.1	16.1
32.00	18.8	18.8	18.5	16.7	16.7	16.6	19.5	20.3	20.3
34.00	19.8	19.8	21.1	20.5	19.4	20.5	22.6	21.3	21.3
36.00	24.4	24.4	24.4	23.2	23.0	23.2	26.4	25.9	25.9
38.00	26.7	26.7	27.1	27.0	27.8	27.0	29.2	28.5	28.5
40.00	30.6	30.6	30.5	30.2	30.4	30.2	33.1	32.5	32.5
42.00	32.6	32.6	34.3	35.1	36.6	35.1	36.8	34.6	34.6
44.00	37.0	36.9	37.1	37.4	40.0	37.4	39.8	39.0	39.0
46.00	40.0	40.0	41.1	43.0	46.1	43.0	43.5	42.2	42.2
48.00	44.0	44.0	45.7	47.1	47.7	47.1	47.9	46.2	46.2
50.00	47.5	47.5	48.6	50.8	53.1	50.8	50.5	49.7	49.6
52.00	51.7	51.7	52.9	54.7	55.8	54.7	54.5	53.6	53.6
54.00	54.1	54.1	56.3	58.5	60.0	58.5	57.6	55.9	55.9
56.00	58.5	58.5	60.7	62.4	62.8	62.3	61.8	59.8	59.8
58.00	61.6	61.6	63.2	64.8	66.8	64.8	64.3	62.7	62.7
60.00	64.6	64.6	66.6	67.9	69.7	67.9	67.5	65.5	65.5
62.00	66.9	66.9	69.2	70.6	72.7	70.6	70.0	67.6	67.6
64.00	70.2	70.2	71.3	72.5	75.1	72.5	72.2	70.7	70.7
66.00	72.1	72.1	74.0	75.0	77.5	75.0	74.7	72.6	72.6
68.00	74.5	74.5	76.0	75.7	78.6	76.7	76.4	75.0	75.0
70.00	76.0	76.0	77.9	78.3	80.2	78.3	78.1	76.4	76.4
72.00	78.1	78.1	79.4	79.7	81.3	79.7	79.4	78.3	78.3
74.00	79.2	79.2	81.0	80.9	82.2	80.9	80.8	79.3	79.3
76.00	80.8	80.8	82.1	82.0	82.8	82.0	81.8	80.9	80.9
78.00	81.9	81.9	82.8	82.6	83.4	82.6	82.5	81.8	81.8
80.00	82.9	82.9	83.6	83.4	83.9	83.4	83.4	82.8	82.8

Table A7

ENCIRCLED ENERGY

1.75 Arc Second Nominal Cube

CIRCLE RADIUS (MICRONS)	PERCENT ENERGY WITHIN CIRCLE CENTERED AT INDICATED COORDINATES								
CENTER (MICRONS): X=	-10.13	10.13	0.0	-10.13	0.0	10.13	0.0	-10.13	10.13
Y=	-10.13	-10.13	-10.13	0.0	0.0	0.0	10.13	10.13	10.13
5.00	0.2	0.2	0.3	0.1	0.3	0.1	0.3	0.3	0.3
10.00	0.9	0.9	0.9	0.5	0.6	0.5	1.2	1.3	1.3
15.00	3.0	3.0	2.7	2.2	1.7	2.2	3.4	3.4	3.4
20.00	5.8	5.8	5.4	4.6	3.7	4.6	6.2	6.4	6.4
25.00	9.3	9.3	9.8	9.1	9.1	9.1	10.4	10.3	10.3
30.00	14.6	14.6	15.4	14.4	14.8	14.4	16.2	16.1	16.1
35.00	22.5	22.5	22.6	21.2	22.0	21.2	24.2	23.9	23.9
40.00	30.6	30.6	30.5	30.2	30.4	30.2	33.1	32.5	32.5
45.00	38.6	38.6	39.3	41.1	43.5	41.1	41.8	40.7	40.7
50.00	47.5	47.5	48.6	50.8	53.1	50.8	50.5	49.7	49.6
55.00	57.0	57.0	58.7	60.4	62.1	60.4	60.0	58.4	58.4
60.00	64.6	64.6	66.6	67.9	69.7	67.9	67.5	65.5	65.5
65.00	71.1	71.1	73.0	74.1	76.6	74.1	73.7	71.6	71.6
70.00	76.0	76.0	77.9	78.3	80.2	78.3	78.1	76.4	76.4
75.00	80.2	80.2	81.5	81.8	82.5	81.5	81.4	80.2	80.2
80.00	82.9	82.9	83.6	83.4	83.9	83.4	83.4	82.8	82.8
85.00	84.5	84.5	84.9	84.8	85.1	84.8	85.0	84.5	84.5
90.00	85.8	85.8	86.0	86.0	86.1	86.0	86.2	85.9	85.9
95.00	86.9	86.9	86.9	87.1	87.2	87.1	87.2	87.1	87.1
100.00	87.9	87.9	87.9	88.1	88.3	88.1	88.0	88.0	88.0
105.00	88.7	88.7	88.9	89.0	89.2	89.0	88.9	88.7	88.7
110.00	89.5	89.5	89.7	89.7	89.9	89.7	89.6	89.5	89.5
115.00	90.2	90.2	90.3	90.2	90.4	90.2	90.3	90.2	90.2
120.00	90.8	90.8	90.9	90.8	90.9	90.8	90.9	90.8	90.8
125.00	91.2	91.2	91.3	91.3	91.3	91.3	91.5	91.3	91.3
130.00	91.7	91.7	91.7	91.8	91.8	91.8	91.9	91.8	91.8
135.00	92.2	92.2	92.2	92.2	92.3	92.2	92.2	92.2	92.2
140.00	92.6	92.6	92.6	92.7	92.7	92.7	92.7	92.6	92.6
145.00	93.0	93.0	93.0	93.1	93.1	93.1	93.1	93.0	93.0
150.00	93.3	93.3	93.4	93.4	93.5	93.4	93.4	93.4	93.4
155.00	93.7	93.7	93.7	93.7	93.7	93.7	93.7	93.7	93.7
160.00	94.1	94.1	94.1	94.0	94.0	94.0	94.0	94.0	94.0
165.00	94.4	94.4	94.4	94.3	94.3	94.3	94.3	94.3	94.3
170.00	94.6	94.6	94.7	94.7	94.7	94.7	94.7	94.6	94.6
175.00	94.9	94.9	94.9	94.9	95.0	94.9	95.0	94.9	94.9
180.00	95.2	95.2	95.2	95.2	95.3	95.2	95.3	95.2	95.2
184.99	95.5	95.5	95.4	95.5	95.5	95.5	95.5	95.5	95.5
189.99	95.7	95.7	95.7	95.8	95.7	95.8	95.7	95.7	95.7
194.99	95.9	95.9	95.9	96.0	96.0	96.0	95.9	96.0	96.0
199.99	96.2	96.2	96.2	96.2	96.2	96.2	96.1	96.2	96.2

Figure 22

Wavefront Map - Q Polarization

0.9 Arc-Second Off-Nominal Cube

MAP IN UNITS OF 0.01 WAVES

										14	12	11	10	9	10	13	16	20	23										
							14	13	11	10	9	8	6	5	6	9	13	16	19	23	26	30							
						12	10	9	8	6	5	4	3	1	2	6	9	12	16	19	23	26	29							
					9	8	7	5	4	3	2	0	0	-1	0	2	5	9	12	16	19	22	26	29						
				7	6	4	3	2	1	0	-1	-2	-4	-5	-4	-1	2	5	9	12	15	19	22	25	29					
			5	3	2	1	0	-1	-2	-3	-5	-6	-7	-9	-8	-4	-1	2	5	8	12	15	18	22	25	29				
		2	1	0	0	-2	-3	-4	-6	-7	-8	-10	-11	-12	-11	-8	-4	-1	1	5	8	11	15	18	22	25	28			
	75	0	-2	-3	-4	-5	-7	-8	-9	-11	-12	-13	-15	-16	-15	-11	-8	-5	-1	1	4	8	11	15	18	21	25	102		
	77	72	68	-6	-8	-9	-10	-12	-13	-14	-16	-17	-18	-19	-18	-15	-12	-8	-5	-2	1	4	8	11	14	91	96	100		
	79	74	70	65	-11	-13	-14	-15	-17	-18	-19	-20	-22	-23	-22	-19	-15	-12	-9	-5	-2	1	4	7	85	90	94	98		
85	80	76	72	67	63	58	-18	-19	-20	-21	-23	-24	-25	-27	-26	-22	-19	-16	-12	-9	-5	-2	74	79	83	88	92	97	101	
87	82	78	73	69	64	60	56	51	-24	-25	-26	-28	-29	-30	-29	-26	-23	-19	-16	-12	64	68	73	77	81	86	90	95	99	
88	84	80	75	71	66	62	57	53	49	44	-30	-31	-33	-34	-33	-30	-26	-23	53	58	62	66	71	75	80	84	89	93	97	
90	86	81	77	72	68	64	59	55	50	46	41	-35	-36	-38	-37	-33	-30	47	51	56	60	65	69	73	78	82	87	91	96	
92	88	83	79	74	70	65	61	57	52	48	43	39	34	-41	-40	36	41	45	49	54	58	63	67	72	76	81	85	89	94	
94	89	85	81	76	72	67	63	58	54	49	45	41	36	-40	-41	34	39	43	48	52	57	61	65	70	74	79	83	88	92	
96	91	87	82	78	73	69	65	60	56	51	47	-30	-33	-37	-38	-36	-35	41	46	50	55	59	64	68	72	77	81	86	90	
97	93	89	84	80	75	71	66	62	58	53	-23	-26	-30	-33	-34	-33	-31	-30	44	49	53	57	62	66	71	75	80	84	88	
99	95	90	86	81	77	73	68	64	-12	-16	-19	-23	-26	-29	-30	-29	-28	-26	-25	-24	51	56	60	64	69	73	78	82	87	
101	97	92	88	83	79	74	-2	-5	-9	-12	-16	-19	-22	-26	-27	-25	-24	-23	-21	-20	-19	-18	58	63	67	72	75	80	85	
	98	94	90	85	7	4	1	-2	-5	-9	-12	-15	-19	-22	-23	-22	-20	-19	-18	-17	-15	-14	-13	-11	65	73	74	79		
	100	96	91	14	11	8	4	1	-2	-5	-8	-12	-15	-18	-19	-18	-17	-16	-14	-13	-12	-10	-9	-8	-6	68	72	77		
	102	25	21	18	15	11	8	4	1	-1	-5	-8	-11	-15	-16	-15	-13	-12	-11	-9	-8	-7	-5	-4	-3	-2	0	75		
		28	25	22	18	15	11	8	5	1	-1	-4	-8	-11	-12	-11	-10	-8	-7	-6	-4	-3	-2	0	0	1	2			
			29	25	22	18	15	12	8	5	2	-1	-4	-8	-9	-7	-6	-5	-3	-2	-1	0	1	2	3	5				
				29	25	22	19	15	12	9	5	2	-1	-4	-5	-4	-2	-1	0	1	2	3	4	6	7					
					29	26	22	19	16	12	9	5	2	0	-1	0	0	2	3	4	5	7	8	9						
						29	26	23	19	16	12	9	6	2	1	3	4	5	6	8	9	10	12							
							30	26	23	19	16	13	9	6	5	6	8	9	10	11	13	14							
										23	20	16	13	10	9	10	11	12	14										

Figure A26

Wavefront Plot - Q Polarization

0.9 Arc-Second Off-Nominal Cube

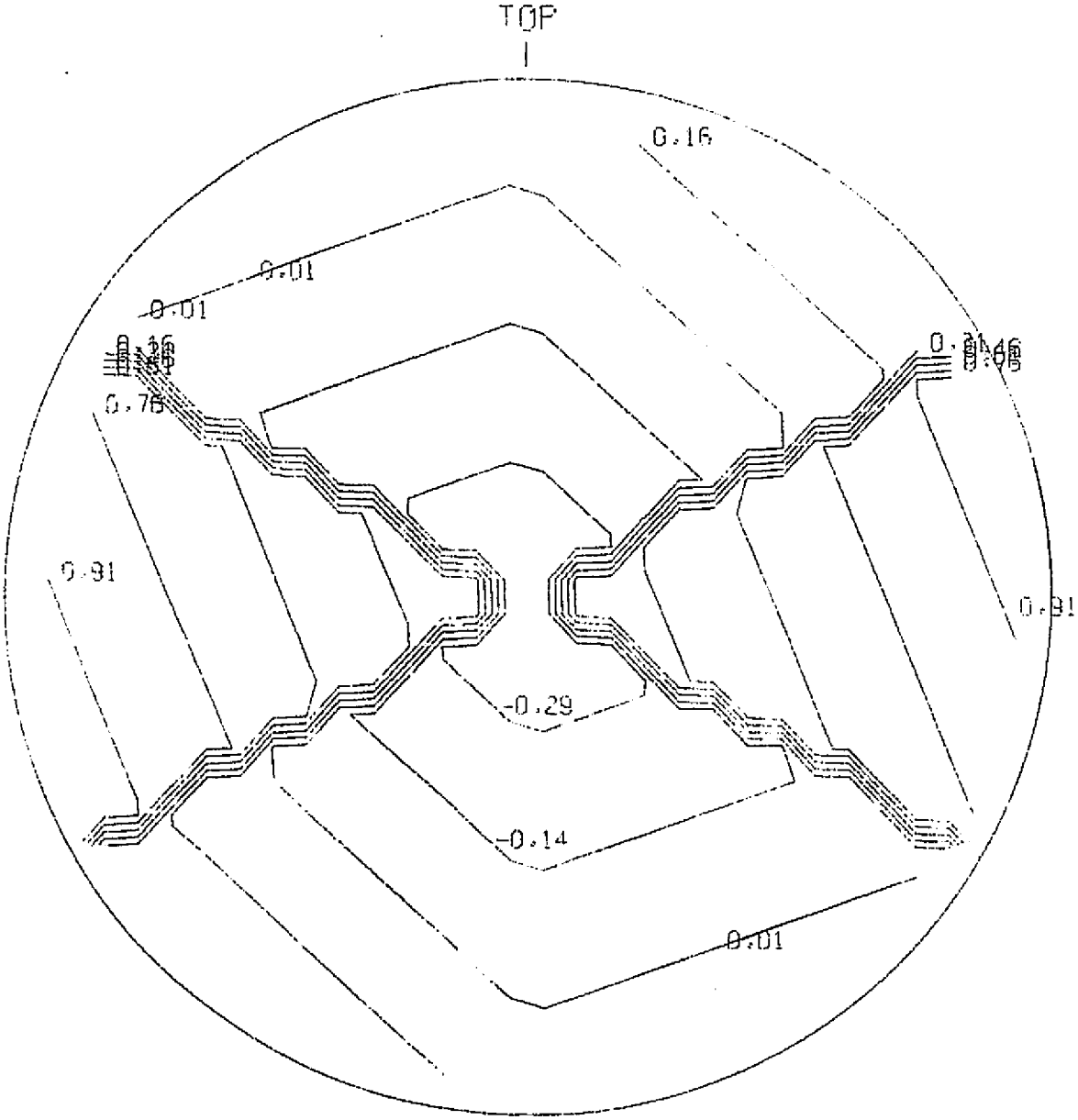


Figure A27

Wavefront Map - P Polarization

0.9 Arc-Second Off-Nominal Cube

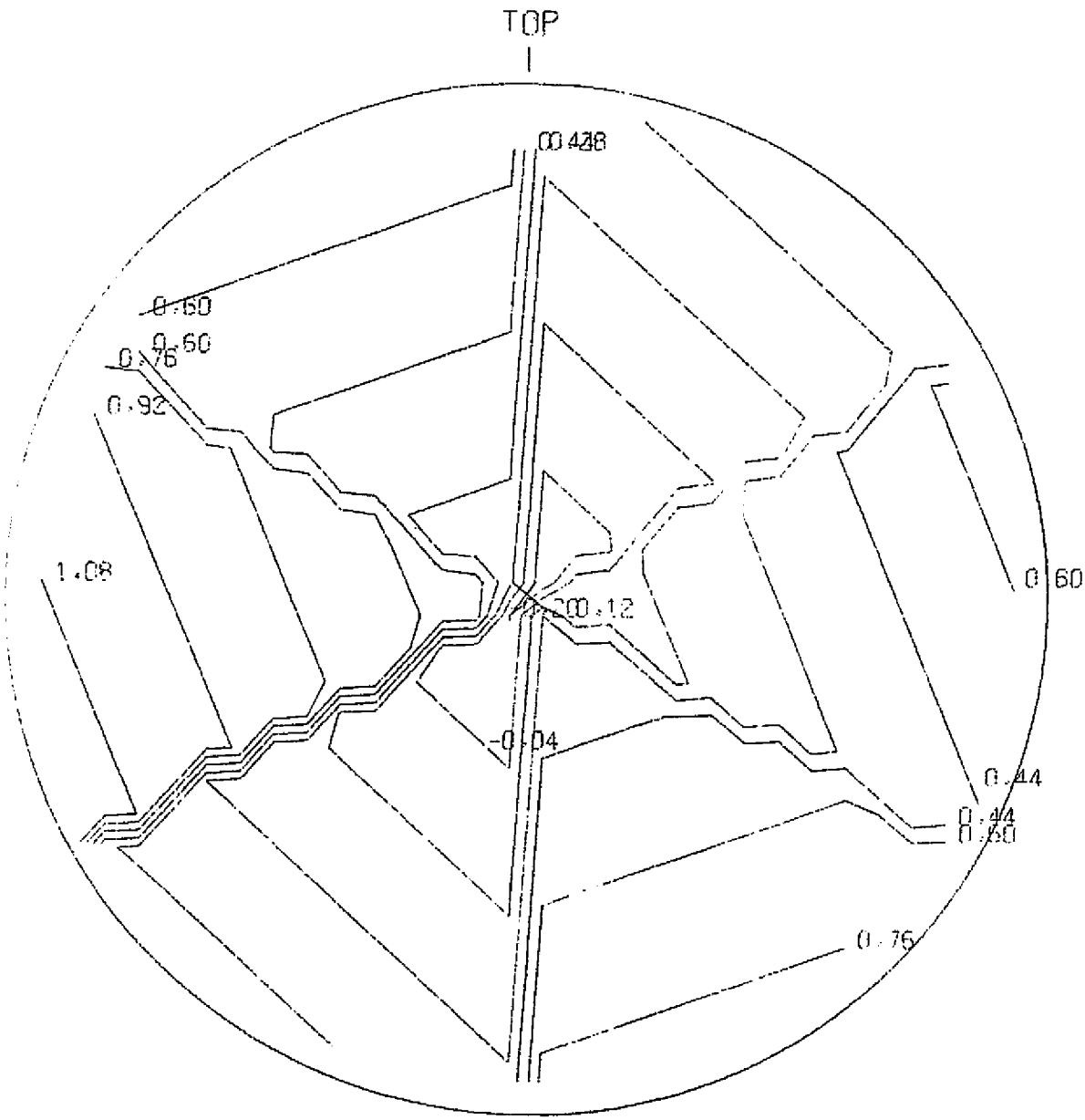
MAP IN UNITS OF 0.01 WAVES

									72	71	70	68	67	18	21	25	28	32											
						73	71	70	69	67	66	65	63	14	18	21	25	28	31	35	38								
					70	69	68	66	65	64	62	61	60	11	14	18	21	24	28	31	34	38								
				68	67	65	64	63	61	60	59	57	56	-7	11	14	17	21	24	27	31	34	38							
			66	64	63	62	60	59	58	56	55	54	53	4	7	10	14	17	20	24	27	31	34	37					
		63	62	61	59	58	57	55	54	53	52	50	49	0	3	7	10	13	17	20	24	27	30	34	37				
	61	60	58	57	56	54	53	52	51	49	48	47	45	-3	0	3	6	10	13	17	20	23	27	30	34	37			
91	57	56	55	53	52	51	49	48	47	46	44	43	42	-6	-3	0	3	6	10	13	16	20	23	27	30	33	68		
93	88	84	81	50	48	47	46	45	43	42	41	39	38	-10	-7	-3	0	3	6	9	13	16	20	23	57	62	66		
95	90	86	81	46	45	44	42	41	40	38	37	36	34	-14	-10	-7	-3	0	2	6	9	12	16	51	56	60	64		
101	96	92	88	83	79	74	40	39	37	36	35	33	32	31	-17	-14	-10	-7	-4	0	2	5	40	45	49	54	58	63	67
103	98	94	89	85	80	76	72	67	34	32	31	30	28	27	-21	-17	-14	-11	-7	-4	30	34	39	43	47	52	56	61	65
104	100	96	91	87	82	78	73	69	65	60	27	26	25	24	-24	-21	-18	-14	19	24	28	32	37	41	46	50	55	59	63
106	102	97	93	88	84	80	75	71	66	62	57	23	21	20	-28	-25	-21	13	17	22	26	31	35	39	44	48	53	57	62
108	104	99	95	90	86	81	77	73	68	64	59	55	50	16	-32	2	7	11	15	20	24	29	33	38	42	47	51	55	60
110	105	101	97	92	88	83	79	74	70	65	61	57	52	-20	28	0	5	9	14	18	23	27	31	36	40	45	49	54	58
112	107	103	98	94	89	85	81	76	72	67	63	-10	-13	-16	32	33	34	7	12	16	21	25	30	34	38	43	47	52	56
113	109	105	100	96	91	87	82	78	74	69	-3	-6	-9	-13	35	37	38	39	10	15	19	23	28	32	37	41	46	50	54
115	111	106	102	97	93	89	84	80	7	3	0	-2	-6	-9	39	40	41	43	44	45	17	22	26	30	35	39	44	48	53
117	113	108	104	99	95	90	17	14	10	7	4	0	-2	-6	43	44	45	46	48	49	50	52	24	29	33	38	42	46	51
114	110	106	101	27	24	21	17	14	11	7	4	0	-2	46	47	49	50	51	53	54	55	57	58	31	36	40	45		
116	112	107	34	31	28	24	21	18	14	11	7	4	1	50	51	52	54	55	56	58	59	60	61	63	34	38	43		
118	45	41	38	35	31	28	25	21	18	14	11	8	4	53	55	56	57	59	60	61	62	64	65	66	68	69	41		
48	45	42	38	35	32	28	25	21	18	15	11	8	57	58	60	61	62	64	65	66	67	69	70	71	73				
49	45	42	39	35	32	28	25	22	18	15	12	61	62	63	65	66	67	68	70	71	72	74	75						
49	46	42	39	35	32	29	25	22	19	15	64	66	67	68	69	71	72	73	75	76	77								
49	46	42	39	36	32	29	26	22	19	68	69	70	72	73	74	76	77	78	80										
49	46	43	39	36	33	29	26	22	71	73	74	75	77	78	79	81	82												
50	46	43	40	36	33	29	26	75	76	78	79	80	82	83	84														
						43	40	36	33	30	79	80	81	83	84														

Figure A28

0.9 Arc-Second Off-Nominal Cube

Wavefront Plot - P Polarization



ORIGINAL PAGE IS
OF POOR QUALITY

Figure A29

PRINTER MAP OF POINT SPREAD FUNCTION
0.9 Arc-Second Off-Nominal Cube
(ONE SPACE REPRESENTS 8.04 MICRONS)
NORMALIZED SO LARGEST VALUE = 0.0510 = 100
TOTAL ENERGY = 0.24610000+01
MAP REPRESENTS 0.23157870+01 OR 94.0995 PERCENT OF TOTAL ENERGY

```
 0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
 0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  1  0  0  0  0
 0  0  0  0  1  0  0  0  0  0  0  1  1  1  0  0  0  0  0  0  0  0  0  1  1  0  0  0  0  0  1  0  0  0  0
 0  0  0  0  0  1  0  0  0  0  0  0  0  1  1  1  1  0  0  0  0  0  0  0  1  1  1  0  0  0  0  0  0  0  0
 0  0  0  0  0  0  1  0  0  0  0  0  1  1  1  1  1  0  0  0  0  0  1  1  1  1  0  0  1  1  0  0  0  0  0
 0  0  0  0  0  0  0  0  0  0  1  1  1  1  1  1  0  0  0  0  0  0  0  1  1  0  0  0  1  1  0  0  0  0  0
 0  0  0  0  0  0  0  0  1  0  0  1  1  1  1  1  0  0  1  1  1  2  1  0  1  0  0  1  0  0  0  0  0  0  0
 0  0  0  0  0  0  0  1  0  0  0  1  1  1  1  2  2  2  2  2  1  2  2  2  1  1  0  0  0  0  0  0  0  0  0
 0  0  0  0  0  0  0  1  1  0  0  1  0  1  2  1  1  2  2  2  1  2  2  1  1  1  0  0  0  0  0  0  0  0  0
 0  0  0  0  0  0  1  1  1  1  0  1  2  2  2  3  2  1  1  1  2  2  1  2  1  1  1  1  0  0  0  0  0  0  0
 0  0  0  0  0  0  0  0  1  1  1  1  1  1  4  5  3  3  3  5  5  2  1  2  1  1  1  0  0  0  0  0  0  0  0
 0  0  0  0  0  0  0  0  0  2  1  1  2  2  3  5  7 12 13 11  9  7  4  2  1  0  0  0  0  0  0  0  0  0  0
 0  0  0  0  0  0  0  1  2  1  1  2  3  7 14 14 17 28 27 16 11  8  4  2  1  0  0  0  0  0  0  0  0  0  0
 0  0  1  1  1  0  1  1  2  3  2  1  3  7 17 23 23 37 57 46 29 21 11  6  5  2  1  1  1  1  0  0  0  0  0
 0  0  1  1  0  1  1  2  1  2  3  6  8  7 15 25 42 88 94 46 23 25 16 10  6  2  2  2  2  1  0  1  1  1  0
 0  1  1  0  0  1  1  1  1  2  4 10 12  8 28 31 29 75 76 33 22 23 19 14  6  1  2  3  2  1  0  1  1  1  0
 0  1  1  1  0  1  1  2  1  3  4 12 21 22 40 23 18 64 46 17 27 24 20 15  7  2  2  3  2  1  0  1  1  1  0
 0  0  0  0  0  1  1  2  1  1  4 10 19 14 10  2 44 98 45  1  9 11 15  9  4  2  0  1  1  1  0  0  0  1  0
 0  1  0  0  1  2  1  1  1  3  6  7  7  1  5 24 59 68 37 33 24  9 12  5  2  2  1  1  1  1  0  0  0  0  0
 1  1  0  1  1  2  1  1  2  3  5  3  4 11 31 69 95 74 59 69 42 14 12  3  1  2  1  1  0  1  0  1  0  1  0
 0  0  0  0  1  1  1  1  2  1  2  3 13 36 50 70100 92 59 39 23 16 14  4  1  1  1  1  0  0  0  0  0  0  0
 0  0  0  0  0  1  1  1  1  1  4  9 20 43 56 53 53 44 25 18 17 14  9  4  2  2  1  1  1  1  1  0  0  0  0
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 0  0  0  0  0  0  0  0  0  0  0  1  3  3  3  8 13 12  9  5  1  2  1  1  2  2  0  0  0  0  0  0  0  0  0
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 0  0  0  0  0  0  0  1  1  1  2  1  1  1  1  0  0  0  0  0  0  1  1  1  1  0  1  1  1  1  0  0  0  0  0  0
 0  0  0  0  0  0  1  1  1  1  1  1  1  1  1  0  0  0  0  0  0  0  1  1  1  1  0  0  0  0  1  1  0  0  0  0
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 0  0  0  0  1  0  0  1  0  0  0  1  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
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 0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  1  1  1  0  0  0  0  0  0  0  0  0
ID
ID
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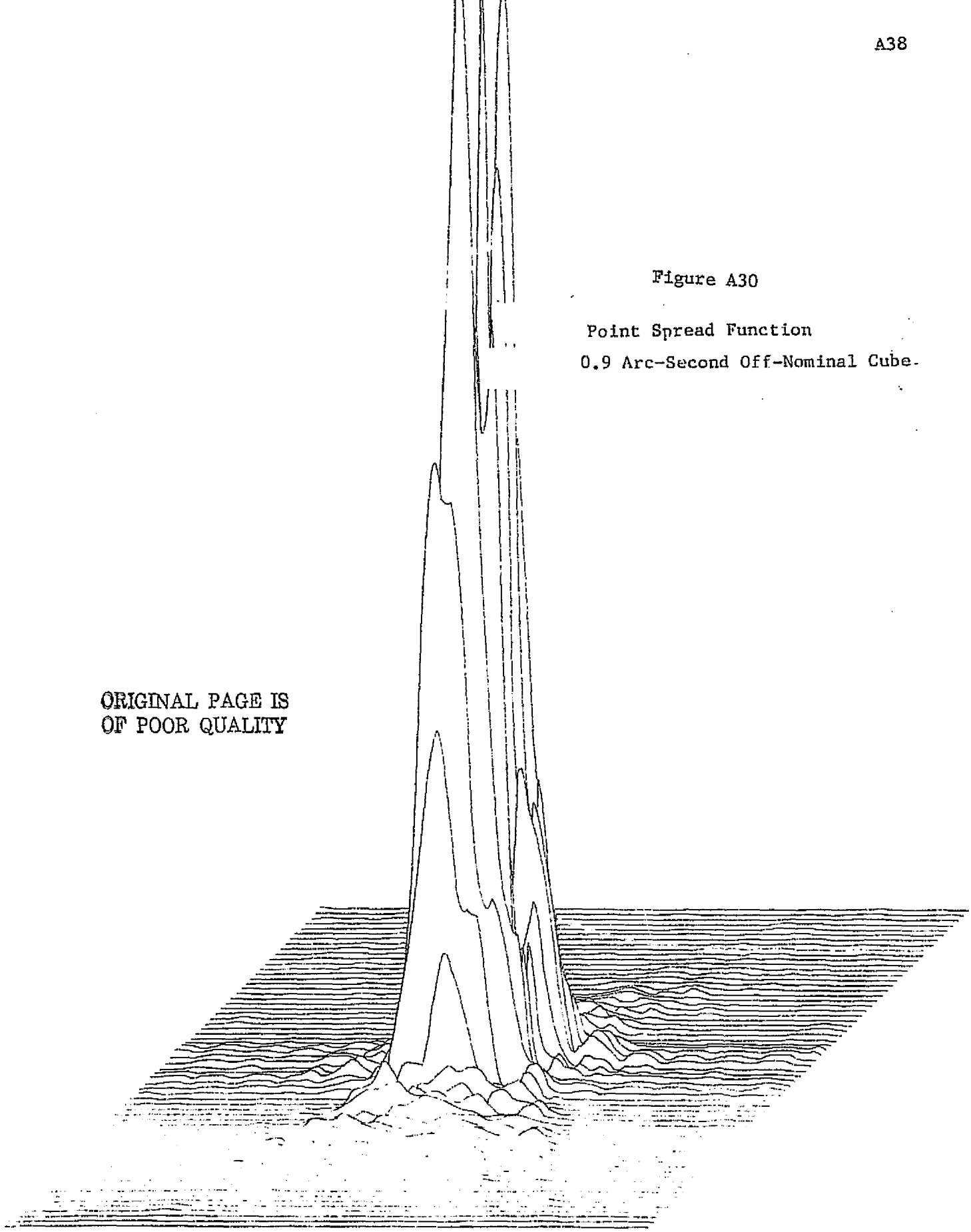


Figure A30

Point Spread Function

0.9 Arc-Second Off-Nominal Cube.

Figure A31

Intensity Distribution - Central 129 Microradians
0.9 Arc-Second Off-Nominal Cube

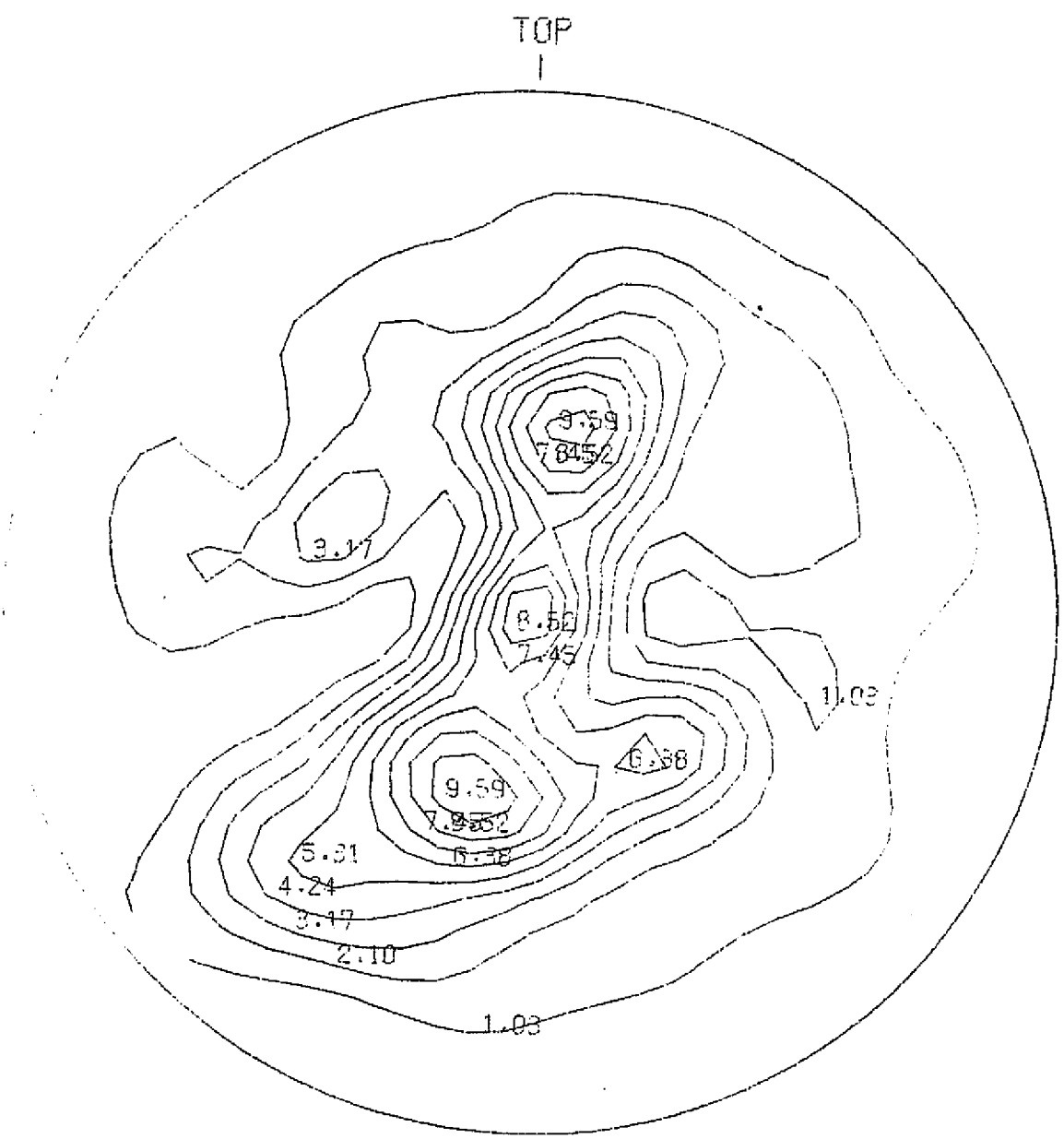
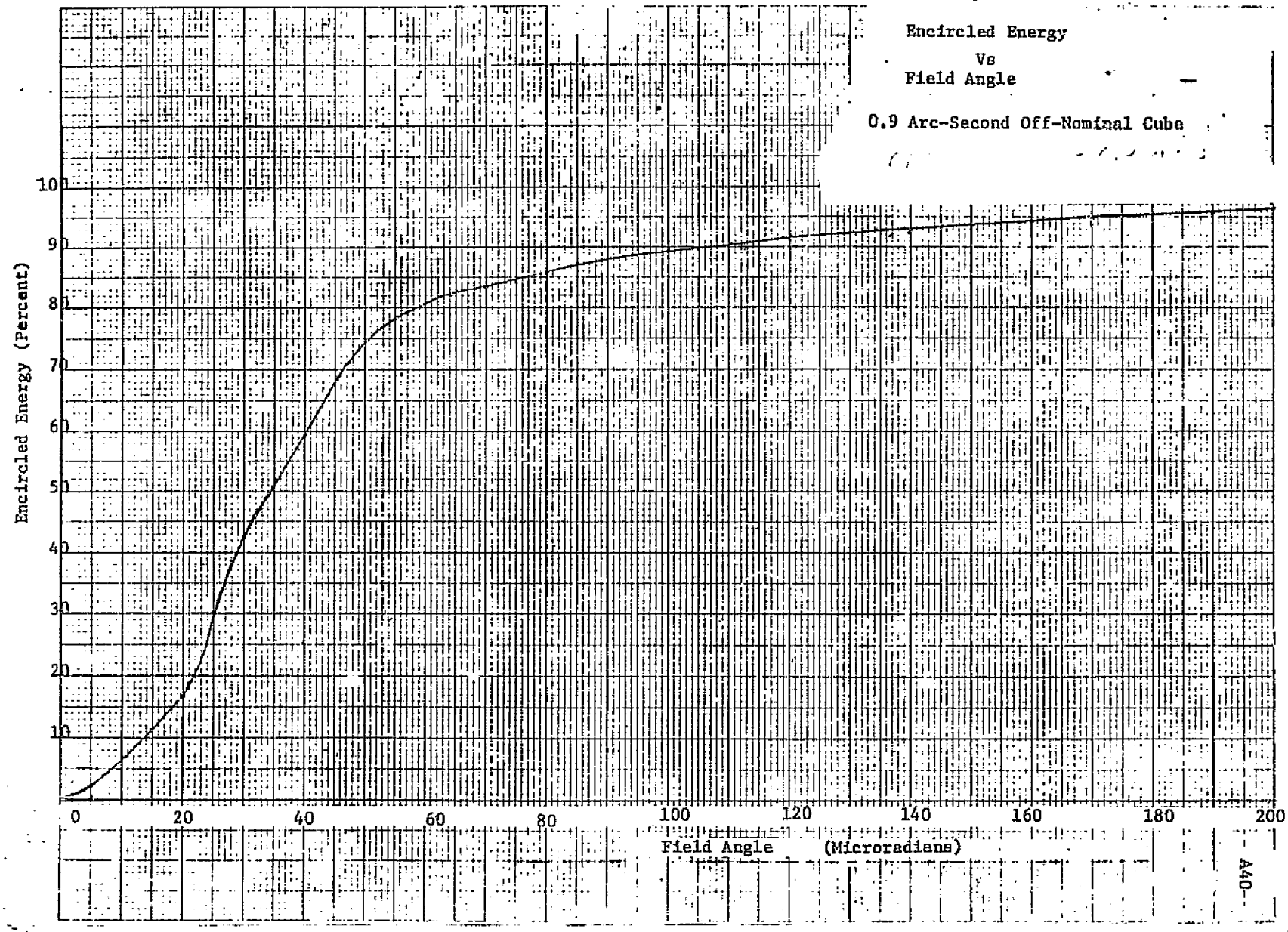


Figure A32

Encircled Energy
Vs
Field Angle

0.9 Arc-Second Off-Nominal Cube



ENCIRCLED ENERGY

0.9 Arc-Second Off-Nominal Cube

CIRCLE RADIUS (MICRONS)	PERCENT ENERGY WITHIN CIRCLE CENTERED AT INDICATED COORDINATES								
	CENTER (MICRONS):								
	X= -10.13	10.13	0.0	-10.13	0.0	10.13	0.0	-10.13	10.13
	Y= -10.13	-10.13	-10.13	0.0	0.0	0.0	10.13	10.13	10.13
2.00	0.0	0.0	0.3	0.1	0.5	0.1	0.3	0.0	0.0
4.00	0.4	0.9	0.7	0.3	0.5	0.3	0.7	1.3	0.9
6.00	0.4	0.9	2.1	0.9	3.7	1.0	2.4	1.3	0.9
8.00	1.6	2.8	4.0	2.2	3.7	2.2	4.3	3.7	2.8
10.00	2.4	3.8	5.2	2.9	6.9	2.9	5.9	5.0	3.9
12.00	6.1	8.0	8.3	5.2	7.7	5.3	9.4	9.6	8.3
14.00	6.1	8.0	10.5	8.1	10.1	8.3	12.8	9.6	8.3
16.00	11.0	12.9	13.7	10.4	11.7	10.7	16.3	14.9	13.6
18.00	13.1	14.9	15.8	13.7	16.9	14.1	19.2	17.3	15.9
20.00	17.1	18.6	20.0	17.3	16.9	17.7	23.6	21.2	20.0
22.00	19.2	20.7	22.4	21.8	24.0	22.4	26.3	23.5	22.2
24.00	23.7	25.2	25.3	24.1	27.1	24.6	29.2	28.2	26.8
26.00	25.7	27.3	28.4	29.5	34.1	30.0	32.0	30.7	29.0
28.00	30.1	32.1	33.1	34.5	35.9	34.9	36.8	35.4	33.4
30.00	33.3	35.4	36.2	39.2	42.4	39.5	39.2	39.1	36.8
32.00	39.2	41.4	40.6	42.8	45.1	42.8	43.6	44.6	42.3
34.00	40.3	42.6	44.3	48.1	49.2	48.0	47.0	45.8	43.5
36.00	46.6	48.5	49.0	51.6	53.0	51.4	51.7	51.1	49.2
38.00	49.3	51.2	52.5	55.4	57.2	55.1	54.6	53.5	51.9
40.00	54.1	55.2	56.4	58.7	59.5	58.4	58.7	57.2	56.4
42.00	56.6	57.5	59.9	52.4	64.1	62.1	61.8	59.2	58.6
44.00	61.2	61.3	62.5	54.3	66.6	63.9	64.5	62.6	62.7
46.00	63.8	63.5	65.5	57.6	70.6	67.3	67.2	64.7	65.3
48.00	67.2	66.2	68.5	70.1	71.7	69.9	69.9	67.5	68.4
50.00	69.4	68.5	70.5	71.9	74.7	71.7	71.5	69.7	70.6
52.00	72.1	70.8	73.0	74.0	75.9	73.9	73.8	71.6	72.8
54.00	73.5	72.2	75.1	75.7	77.6	75.7	75.3	73.1	74.1
56.00	75.9	74.6	77.3	77.5	78.6	77.5	77.2	75.1	76.1
58.00	77.4	76.3	78.5	78.5	79.8	78.5	78.3	76.6	77.4
60.00	79.0	77.7	79.9	79.7	80.6	79.7	79.5	77.8	78.7
62.00	80.0	78.8	80.8	80.5	81.4	80.5	80.4	78.9	79.7
64.00	81.4	80.3	81.5	81.2	82.1	81.2	81.3	80.1	81.0
66.00	82.0	81.1	82.2	82.0	82.7	82.0	82.1	81.1	81.7
68.00	82.8	82.0	82.8	82.6	83.0	82.6	82.8	82.1	82.7
70.00	83.2	82.6	83.4	83.2	83.5	83.2	83.5	82.7	83.2
72.00	83.8	83.5	83.8	83.8	84.0	83.7	84.0	83.6	83.9
74.00	84.1	83.9	84.4	84.4	84.5	84.3	84.6	84.0	84.3
76.00	84.6	84.6	84.8	84.9	84.8	84.8	85.1	84.7	84.8
78.00	85.0	85.1	85.1	85.3	85.4	85.3	85.4	85.3	85.2
80.00	85.4	85.6	85.6	85.7	85.8	85.7	85.8	85.8	85.6

ENCIRCLED ENERGY

0.9 Arc-Second Off-Nominal Cube

CIRCLE RADIUS (MICRONS)	PERCENT ENERGY WITHIN CIRCLE CENTERED AT INDICATED COORDINATES								
	CENTER (MICRONS):								
	X= -10.13	10.13	0.0	-10.13	0.0	10.13	0.0	-10.13	10.13
	Y= -10.13	-10.13	-10.13	0.0	0.0	0.0	10.13	10.13	10.13
5.00	0.4	0.9	1.8	0.9	2.2	1.0	2.0	1.3	0.9
10.00	2.4	3.8	5.2	2.9	6.9	2.9	5.9	5.0	3.9
15.00	9.1	10.9	13.0	9.4	11.7	9.6	15.3	12.8	11.5
20.00	17.1	18.6	20.0	17.3	16.9	17.7	23.6	21.2	20.0
25.00	25.0	26.6	27.4	28.9	30.2	29.4	31.4	29.8	28.3
30.00	33.3	35.4	36.2	39.2	42.4	39.5	39.2	39.1	36.8
35.00	44.4	46.3	46.9	49.0	52.0	49.0	49.2	48.9	46.9
40.00	54.1	55.2	56.4	58.7	59.5	58.4	58.7	57.2	56.4
45.00	62.7	62.5	64.2	66.5	68.8	66.2	66.0	64.0	64.3
50.00	69.4	68.5	70.5	71.9	74.7	71.7	71.5	69.7	70.6
55.00	75.1	73.8	76.3	76.7	78.4	76.7	76.4	74.2	75.3
60.00	79.0	77.7	79.9	79.7	80.6	79.7	79.5	77.8	78.7
65.00	81.7	80.6	82.0	81.7	82.5	81.7	81.8	80.6	81.4
70.00	83.2	82.6	83.4	83.2	83.5	83.2	83.5	82.7	83.2
75.00	84.4	84.4	84.6	84.6	84.6	84.6	84.8	84.5	84.6
80.00	85.4	85.6	85.6	85.7	85.8	85.7	85.8	85.8	85.6
85.00	86.4	86.6	86.7	86.9	87.1	86.9	86.8	86.7	86.6
90.00	87.4	87.5	87.7	87.8	88.0	87.8	87.7	87.6	87.5
95.00	88.5	88.4	88.6	88.5	88.7	88.6	88.5	88.4	88.5
100.00	89.3	89.0	89.3	89.2	89.4	89.2	89.3	89.0	89.2
105.00	89.8	89.6	89.9	89.8	89.9	89.8	90.0	89.7	89.9
110.00	90.3	90.3	90.4	90.4	90.4	90.4	90.5	90.4	90.4
115.00	90.8	90.9	90.8	90.9	91.0	90.9	90.9	91.0	90.9
120.00	91.2	91.4	91.3	91.4	91.5	91.4	91.4	91.4	91.3
125.00	91.7	91.8	91.8	91.9	91.9	91.8	91.8	91.8	91.7
130.00	92.2	92.2	92.2	92.2	92.3	92.2	92.2	92.2	92.2
135.00	92.5	92.6	92.5	92.5	92.6	92.6	92.6	92.6	92.5
140.00	92.9	93.0	93.0	92.9	92.9	93.0	92.9	93.0	92.8
145.00	93.2	93.3	93.3	93.3	93.2	93.3	93.2	93.2	93.2
150.00	93.6	93.6	93.6	93.6	93.7	93.6	93.5	93.5	93.6
155.00	93.9	93.9	93.9	93.9	94.0	93.9	93.9	93.8	93.9
160.00	94.3	94.2	94.2	94.3	94.2	94.3	94.2	94.2	94.3
165.00	94.5	94.5	94.5	94.6	94.5	94.5	94.6	94.5	94.5
170.00	94.8	94.8	94.8	94.8	94.9	94.8	94.8	94.8	94.8
175.00	95.0	95.1	95.1	95.1	95.1	95.1	95.1	95.1	95.0
180.00	95.3	95.4	95.3	95.3	95.4	95.4	95.3	95.3	95.3
184.99	95.6	95.6	95.5	95.6	95.5	95.6	95.5	95.6	95.6
189.99	95.8	95.8	95.8	95.8	95.8	95.8	95.8	95.8	95.8
194.99	96.0	96.0	96.1	96.0	96.1	96.0	96.1	96.0	96.0
199.99	96.3	96.3	96.3	96.3	96.3	96.3	96.3	96.3	96.3

Table A10

ENCIRCLED ENERGY

PERFECT CUBE CORNER

CIRCLE RADIUS (MICRONS)	PERCENT ENERGY WITHIN CIRCLE CENTERED AT INDICATED COORDINATES								
CENTER (MICRONS): X=	-10.13	10.13	0.0	-10.13	0.0	10.13	0.0	-10.13	10.13
Y=	-10.13	-10.13	-10.13	0.0	0.0	0.0	10.13	10.13	10.13
2.00	0.0	0.0	0.4	0.5	1.3	0.5	0.4	0.0	0.0
4.00	1.1	1.1	1.1	1.3	1.3	1.3	1.1	1.9	1.9
6.00	1.1	1.1	3.1	3.8	9.5	3.8	3.4	1.9	1.9
8.00	3.7	3.7	6.4	7.5	9.5	7.5	7.0	5.9	5.9
10.00	5.2	5.2	7.9	9.4	17.6	9.4	9.2	8.0	8.0
12.00	11.9	11.9	13.5	15.2	19.5	15.2	15.6	16.1	16.1
14.00	11.9	11.9	17.3	19.9	24.4	19.9	21.8	16.1	16.1
16.00	20.3	20.2	22.5	25.1	27.2	25.1	27.8	25.2	25.2
18.00	23.7	23.6	26.1	29.1	34.1	29.1	33.3	29.1	29.1
20.00	29.3	29.3	32.3	35.6	34.1	35.5	40.3	34.9	34.9
22.00	32.8	32.8	36.4	39.8	42.3	39.8	45.2	38.8	38.8
24.00	38.9	38.9	39.8	43.5	46.1	43.5	48.6	44.8	44.8
26.00	41.6	41.5	44.9	48.2	54.2	48.2	52.8	47.7	47.7
28.00	46.7	46.6	49.8	53.5	56.3	53.5	57.1	52.1	52.1
30.00	50.2	50.2	54.4	57.2	63.4	57.2	59.5	55.8	55.7
32.00	56.2	56.2	58.3	60.9	66.0	60.9	62.5	60.2	60.2
34.00	57.2	57.1	62.9	64.6	69.7	64.6	65.0	61.1	61.1
36.00	63.1	63.1	67.1	67.8	72.1	67.8	68.2	65.2	65.2
38.00	65.5	65.5	70.2	70.5	74.3	70.5	69.3	66.7	66.7
40.00	69.1	69.1	73.4	72.7	75.2	72.7	72.1	69.5	69.5
42.00	71.3	71.3	75.3	74.6	76.6	74.6	73.5	71.0	71.0
44.00	74.4	74.4	76.5	75.8	77.3	75.8	75.0	73.3	73.3
46.00	75.7	75.7	77.4	76.8	78.2	76.8	76.2	74.7	74.7
48.00	77.3	77.3	78.3	77.8	78.5	77.8	77.5	76.6	76.6
50.00	78.2	78.2	78.6	78.3	79.0	78.3	78.2	77.8	77.8
52.00	79.2	79.2	79.1	79.2	79.3	79.2	79.1	78.8	78.8
54.00	79.6	79.6	79.7	79.8	79.7	79.8	80.0	79.6	79.6
56.00	80.3	80.3	80.2	80.6	80.1	80.6	80.9	80.5	80.5
58.00	80.8	80.8	80.7	81.1	80.8	81.1	81.5	81.3	81.3
60.00	81.4	81.4	81.2	81.7	81.5	81.7	82.1	81.9	81.9
62.00	81.8	81.8	81.9	82.3	82.3	82.3	82.7	82.3	82.3
64.00	82.6	82.6	82.3	82.8	83.1	82.8	83.0	83.1	83.1
66.00	83.0	83.0	83.2	83.5	84.0	83.5	83.7	83.4	83.4
68.00	83.7	83.7	83.7	84.1	84.5	84.1	84.1	84.0	84.0
70.00	84.1	84.1	84.6	84.7	85.2	84.7	84.7	84.3	84.3
72.00	84.8	84.8	85.1	85.2	85.7	85.2	85.1	84.9	84.9
74.00	85.2	85.2	85.9	85.7	86.2	85.7	85.6	85.2	85.2
76.00	85.9	85.9	86.3	86.2	86.6	86.2	86.1	85.7	85.7
78.00	86.3	86.3	86.8	86.5	87.0	86.5	86.4	86.1	86.1
80.00	86.8	86.8	87.1	86.9	87.3	86.9	86.8	86.6	86.6

Table A11

ENCIRCLED ENERGY

PERFECT CUBE CORNER

CIRCLE RADIUS (MICRONS)	PERCENT ENERGY WITHIN CIRCLE CENTERED AT INDICATED COORDINATES								
	CENTER (MICRONS):								
	X= -10.13	10.13	0.0	-10.13	0.0	10.13	0.0	-10.13	10.13
	Y= -10.13	-10.13	-10.13	0.0	0.0	0.0	10.13	10.13	-10.13
5.00	1.1	1.1	2.8	3.6	5.7	3.6	3.1	1.9	1.9
10.00	5.2	5.2	7.9	9.4	17.6	9.4	9.2	8.0	8.0
15.00	17.0	16.9	21.4	23.6	27.2	23.6	26.0	21.6	21.6
20.00	29.3	29.3	32.3	35.6	34.1	35.5	40.3	34.9	34.9
25.00	40.7	40.7	43.7	47.3	49.6	47.3	52.3	46.7	46.7
30.00	50.2	50.2	54.4	57.2	63.4	57.2	59.5	55.8	55.7
35.00	61.2	61.2	65.1	66.0	71.5	66.0	66.2	63.5	63.5
40.00	69.1	69.1	73.4	72.7	75.2	72.7	72.1	69.5	69.5
45.00	75.1	75.1	77.1	76.3	77.8	76.3	75.7	74.3	74.3
50.00	78.2	78.2	78.6	78.3	79.0	78.3	78.2	77.8	77.8
55.00	80.1	80.1	79.9	80.3	80.0	80.3	80.4	80.1	80.1
60.00	81.4	81.4	81.2	81.7	81.5	81.7	82.1	81.9	81.9
65.00	82.7	82.7	82.9	83.2	83.6	83.2	83.4	83.2	83.2
70.00	84.1	84.1	84.6	84.7	85.2	84.7	84.7	84.3	84.3
75.00	85.6	85.6	86.1	86.0	86.4	86.0	85.8	85.5	85.5
80.00	86.8	86.8	87.1	86.9	87.3	86.9	86.8	86.6	86.6
85.00	87.6	87.6	87.8	87.7	87.9	87.7	87.7	87.5	87.5
90.00	88.3	88.3	88.4	88.4	88.3	88.4	88.5	88.4	88.4
95.00	89.0	89.0	88.8	89.0	88.9	89.0	89.1	89.1	89.1
100.00	89.5	89.5	89.4	89.6	89.7	89.6	89.7	89.7	89.7
105.00	90.0	90.0	90.2	90.2	90.3	90.2	90.2	90.1	90.1
110.00	90.6	90.6	90.8	90.7	90.9	90.7	90.7	90.6	90.6
115.00	91.2	91.2	91.3	91.2	91.4	91.2	91.1	91.1	91.1
120.00	91.6	91.6	91.7	91.6	91.7	91.6	91.6	91.6	91.6
125.00	91.9	91.9	92.0	92.0	92.0	92.0	92.1	92.0	92.0
130.00	92.3	92.3	92.3	92.3	92.4	92.3	92.4	92.4	92.4
135.00	92.7	92.7	92.7	92.7	92.7	92.7	92.5	92.6	92.6
140.00	93.1	93.1	93.1	93.1	93.0	93.1	93.0	93.0	93.0
145.00	93.3	93.3	93.4	93.4	93.3	93.4	93.4	93.3	93.3
150.00	93.7	93.7	93.7	93.7	93.8	93.7	93.7	93.7	93.7
155.00	94.0	94.0	94.0	94.0	94.1	94.0	94.0	94.0	94.0
160.00	94.3	94.3	94.2	94.4	94.3	94.4	94.3	94.3	94.3
165.00	94.6	94.6	94.6	94.6	94.6	94.6	94.6	94.6	94.6
170.00	94.8	94.8	94.9	94.9	95.0	94.9	94.9	94.8	94.8
175.00	95.1	95.1	95.1	95.1	95.1	95.1	95.1	95.1	95.1
180.00	95.3	95.3	95.4	95.4	95.4	95.4	95.4	95.4	95.4
184.99	95.6	95.6	95.6	95.6	95.6	95.6	95.5	95.6	95.6
189.99	95.8	95.8	95.8	95.8	95.8	95.8	95.8	95.8	95.8
194.99	96.0	96.0	96.1	96.1	96.1	96.1	96.1	96.1	96.1
199.99	96.3	96.3	96.2	96.3	96.3	96.3	96.3	96.3	96.3

Table A12

ENCIRCLED ENERGY

0.25 ARC SECOND CUBE

CIRCLE RADIUS (MICRONS)	PERCENT ENERGY WITHIN CIRCLE CENTERED AT INDICATED COORDINATES								
CENTER (MICRONS): X=	-10.13	10.13	0.0	-10.13	0.0	10.13	0.0	-10.13	10.13
Y=	-10.13	-10.13	-10.13	0.0	0.0	0.0	10.13	10.13	10.13
2.00	0.0	0.0	0.5	0.4	1.2	0.4	0.5	0.0	0.0
4.00	1.0	1.0	1.2	1.1	1.2	1.1	1.2	1.8	1.8
6.00	1.0	1.0	3.4	3.2	8.9	3.2	3.7	1.8	1.8
8.00	3.5	3.5	6.8	6.5	8.9	6.5	7.3	5.7	5.6
10.00	5.0	5.0	8.5	8.1	16.6	8.1	9.7	7.7	7.7
12.00	11.5	11.5	14.1	13.5	18.4	13.4	16.1	15.5	15.5
14.00	11.5	11.5	17.6	18.1	23.1	18.1	22.0	15.5	15.5
16.00	19.6	19.6	22.8	22.9	25.8	22.8	27.9	24.4	24.3
18.00	22.9	22.9	26.0	27.1	32.7	27.1	32.9	28.2	28.1
20.00	28.4	28.4	32.2	33.3	32.7	33.3	39.8	33.9	33.8
22.00	31.8	31.8	35.5	38.1	41.0	38.1	44.0	37.6	37.6
24.00	37.9	37.8	39.1	41.6	44.5	41.6	47.5	43.5	43.5
26.00	40.5	40.5	43.4	47.0	52.8	47.0	51.0	46.5	46.4
28.00	45.6	45.5	48.2	52.4	54.8	52.4	55.3	50.8	50.8
30.00	49.1	49.1	52.4	56.6	62.0	56.6	57.3	54.5	54.5
32.00	55.1	55.1	56.6	60.2	64.6	60.2	60.7	59.0	59.0
34.00	56.1	56.1	60.9	64.3	68.3	64.3	63.1	60.0	60.0
36.00	62.0	62.0	65.3	67.4	70.8	67.4	66.6	64.2	64.2
38.00	64.5	64.5	68.5	70.1	73.2	70.1	68.0	65.9	65.9
40.00	68.2	68.2	71.9	72.3	74.2	72.3	71.0	68.8	68.8
42.00	70.4	70.4	74.1	74.1	75.9	74.1	72.7	70.3	70.3
44.00	73.6	73.6	75.6	75.3	76.9	75.3	74.5	72.8	72.8
46.00	75.0	75.0	76.8	76.3	78.0	76.3	75.9	74.2	74.2
48.00	76.7	76.7	77.9	77.4	78.3	77.4	77.4	76.2	76.2
50.00	77.8	77.8	78.5	77.9	79.1	77.9	78.2	77.4	77.4
52.00	78.8	78.8	79.2	78.9	79.4	78.9	79.2	78.5	78.5
54.00	79.3	79.3	79.8	79.5	79.9	79.5	80.1	79.3	79.3
56.00	80.2	80.2	80.4	80.4	80.2	80.4	81.0	80.4	80.3
58.00	80.7	80.7	80.9	80.9	80.9	80.9	81.5	81.1	81.1
60.00	81.4	81.4	81.4	81.6	81.5	81.6	82.1	81.8	81.8
62.00	81.8	81.8	82.0	82.2	82.3	82.2	82.6	82.2	82.2
64.00	82.6	82.6	82.4	82.8	83.0	82.8	82.9	83.0	83.0
66.00	83.0	83.0	83.2	83.5	83.8	83.5	83.5	83.4	83.4
68.00	83.7	83.7	83.6	84.1	84.3	84.1	83.9	83.9	83.9
70.00	84.0	84.0	84.4	84.7	85.0	84.7	84.5	84.3	84.3
72.00	84.7	84.7	84.9	85.2	85.5	85.2	84.9	84.8	84.8
74.00	85.1	85.1	85.7	85.7	86.0	85.7	85.5	85.1	85.1
76.00	85.8	85.8	86.1	86.2	86.4	86.2	86.0	85.7	85.7
78.00	86.2	86.2	86.6	86.4	86.9	86.4	86.3	86.1	86.1
80.00	86.7	86.7	86.9	86.8	87.2	86.8	86.7	86.5	86.5

Table A13

ENCIRCLED ENERGY

0.7 0.25 ARC SECOND CUBE . 1 Cube

CIRCLE RADIUS (MICRONS)	PERCENT ENERGY WITHIN CIRCLE CENTERED AT INDICATED COORDINATES								
	CENTER (MICRONS):								
	X= -10.13	10.13	0.0	-10.13	0.0	10.13	0.0	-10.13	10.13
	Y= -10.13	-10.13	-10.13	0.0	0.0	0.0	10.13	10.13	10.13
5.00	1.0	1.0	3.1	3.0	5.4	3.0	5.3	1.8	1.8
10.00	5.0	5.0	8.5	8.1	16.6	8.1	9.7	7.7	7.7
15.00	16.4	16.4	21.8	21.3	25.8	21.3	26.2	20.8	20.8
20.00	28.4	28.4	32.2	33.3	32.7	33.3	39.8	33.9	33.8
25.00	39.6	39.6	42.3	46.2	48.3	46.1	50.5	45.4	45.4
30.00	49.1	49.1	52.4	56.6	62.0	56.6	57.3	54.5	54.5
35.00	60.1	60.1	63.3	65.5	70.2	65.5	64.6	62.4	62.4
40.00	68.2	68.2	71.9	72.3	74.2	72.3	71.0	68.8	68.8
45.00	74.4	74.4	76.4	75.9	77.4	75.9	75.3	73.8	73.8
50.00	77.8	77.8	78.5	77.9	79.1	77.9	78.2	77.4	77.4
55.00	79.9	79.9	80.1	80.0	80.2	80.0	80.5	79.9	79.9
60.00	81.4	81.4	81.4	81.6	81.5	81.6	82.1	81.8	81.8
65.00	82.8	82.8	82.9	83.2	83.5	83.2	83.2	83.1	83.1
70.00	84.0	84.0	84.4	84.7	85.0	84.7	84.5	84.3	84.3
75.00	85.5	85.5	85.9	86.0	86.2	86.0	85.7	85.4	85.4
80.00	86.7	86.7	86.9	86.8	87.2	86.8	86.7	86.5	86.5
85.00	87.5	87.5	87.8	87.7	87.9	87.7	87.7	87.4	87.4
90.00	88.2	88.2	88.4	88.3	88.4	88.3	88.5	88.3	88.3
95.00	88.9	88.9	88.9	89.0	89.0	89.0	89.1	89.1	89.1
100.00	89.5	89.5	89.4	89.6	89.6	89.6	89.6	89.6	89.6
105.00	90.0	90.0	90.1	90.2	90.3	90.2	90.2	90.1	90.1
110.00	90.6	90.6	90.7	90.7	90.9	90.7	90.7	90.6	90.6
115.00	91.2	91.2	91.2	91.2	91.3	91.2	91.1	91.1	91.1
120.00	91.6	91.6	91.7	91.6	91.7	91.6	91.6	91.6	91.6
125.00	91.9	91.9	92.0	92.0	92.0	92.0	92.1	92.0	92.0
130.00	92.3	92.3	92.3	92.3	92.4	92.3	92.4	92.4	92.4
135.00	92.7	92.7	92.7	92.7	92.7	92.7	92.5	92.6	92.6
140.00	93.1	93.1	93.1	93.1	93.0	93.1	93.0	93.0	93.0
145.00	93.4	93.4	93.4	93.4	93.3	93.4	93.4	93.3	93.3
150.00	93.7	93.7	93.7	93.7	93.8	93.7	93.7	93.7	93.7
155.00	94.0	94.0	94.0	94.0	94.1	94.0	94.1	94.0	94.0
160.00	94.3	94.3	94.3	94.4	94.3	94.4	94.3	94.3	94.3
165.00	94.6	94.6	94.6	94.6	94.6	94.6	94.6	94.6	94.6
170.00	94.8	94.8	94.8	94.9	94.9	94.9	94.9	94.8	94.8
175.00	95.1	95.1	95.1	95.1	95.1	95.1	95.1	95.1	95.1
180.00	95.3	95.3	95.4	95.4	95.4	95.4	95.4	95.4	95.4
184.99	95.6	95.6	95.6	95.6	95.6	95.6	95.6	95.6	95.6
189.99	95.8	95.8	95.9	95.8	95.9	95.8	95.9	95.8	95.8
194.99	96.0	96.0	96.1	96.1	96.1	96.1	96.1	96.1	96.1
199.99	96.3	96.3	96.2	96.3	96.3	96.3	96.3	96.4	96.4

Table A14

ENCIRCLED ENERGY

0.5 ARC SECOND CUBE

CIRCLE RADIUS (MICRONS)	PERCENT ENERGY WITHIN CIRCLE CENTERED AT INDICATED COORDINATES								
	CENTER (MICRONS):								
	X= -10.13	10.13	0.0	-10.13	0.0	10.13	0.0	-10.13	10.13
	Y= -10.13	-10.13	-10.13	0.0	0.0	0.0	10.13	10.13	10.13
2.00	0.0	0.0	0.5	0.3	1.0	0.3	0.5	0.0	0.0
4.00	0.9	0.9	1.1	0.8	1.0	0.8	1.1	1.6	1.6
6.00	0.9	0.9	3.4	2.3	7.4	2.3	3.6	1.6	1.6
8.00	3.1	3.1	6.5	4.9	7.4	4.9	6.9	5.0	5.0
10.00	4.5	4.5	8.1	6.2	13.8	6.2	9.2	6.8	6.8
12.00	10.3	10.3	13.1	10.6	15.3	10.6	15.0	13.9	13.8
14.00	10.3	10.3	16.2	14.9	19.5	14.8	20.1	13.9	13.8
16.00	17.7	17.7	21.0	18.9	21.8	18.9	25.6	21.8	21.8
18.00	20.7	20.7	23.8	23.2	28.5	23.2	29.8	25.3	25.3
20.00	25.9	25.8	29.5	28.7	28.5	28.7	36.2	30.6	30.6
22.00	28.9	28.9	32.3	34.0	36.8	33.9	39.7	34.0	34.0
24.00	34.6	34.6	35.9	37.1	40.2	37.0	43.2	39.6	39.6
26.00	37.1	37.1	39.6	43.0	48.5	42.9	46.2	42.5	42.5
28.00	42.1	42.1	44.5	48.5	50.5	48.5	50.7	46.9	46.9
30.00	45.7	45.6	48.3	53.1	57.7	53.1	52.7	50.7	50.7
32.00	51.8	51.8	52.7	56.7	60.3	56.7	56.5	55.6	55.6
34.00	52.8	52.8	56.8	61.3	64.3	61.3	59.1	56.7	56.7
36.00	58.9	58.9	61.5	64.5	67.0	64.5	63.2	61.3	61.3
38.00	61.5	61.5	64.8	67.5	70.0	67.5	65.0	63.2	63.2
40.00	65.4	65.4	68.5	69.9	71.3	69.9	68.5	66.5	66.5
42.00	67.7	67.7	71.1	72.1	73.8	72.1	70.6	68.2	68.2
44.00	71.1	71.1	73.0	73.4	75.1	73.4	72.8	70.9	70.9
46.00	72.8	72.8	74.8	74.8	77.1	74.8	74.6	72.6	72.6
48.00	74.9	74.8	76.3	76.2	77.6	76.2	76.4	74.8	74.8
50.00	76.2	76.2	77.3	76.9	78.9	76.9	77.4	76.2	76.2
52.00	77.5	77.5	78.4	78.1	79.4	78.1	78.6	77.5	77.5
54.00	78.2	78.2	79.4	79.0	80.1	79.0	79.6	78.5	78.5
56.00	79.5	79.5	80.4	80.1	80.4	80.1	80.6	79.6	79.6
58.00	80.3	80.3	81.0	80.7	81.1	80.7	81.2	80.5	80.5
60.00	81.1	81.1	81.5	81.5	81.6	81.5	81.7	81.3	81.3
62.00	81.6	81.6	82.1	82.1	82.3	82.1	82.3	81.8	81.8
64.00	82.5	82.5	82.4	82.7	82.8	82.7	82.6	82.6	82.6
66.00	82.9	82.9	83.1	83.3	83.5	83.3	83.2	83.1	83.1
68.00	83.6	83.6	83.5	83.8	83.9	83.8	83.6	83.7	83.7
70.00	83.9	83.9	84.1	84.4	84.5	84.4	84.2	84.1	84.1
72.00	84.6	84.6	84.6	84.9	85.0	84.9	84.7	84.7	84.7
74.00	84.9	84.9	85.3	85.4	85.5	85.4	85.3	85.0	85.0
76.00	85.5	85.5	85.7	85.9	85.9	85.9	85.7	85.5	85.5
78.00	85.9	85.9	86.2	86.2	86.5	86.2	86.1	85.9	85.9
80.00	86.4	86.4	86.5	86.6	86.9	86.6	86.6	86.4	86.4

Table A15

ENCIRCLED ENERGY

0.5, 0.5 ARC SECOND CUBE

CIRCLE RADIUS (MICRONS)	PERCENT ENERGY WITHIN CIRCLE CENTERED AT INDICATED COORDINATES								
CENTER (MICRONS): X=	-10.13	10.13	0.0	-10.13	0.0	10.13	0.0	-10.13	10.13
Y=	-10.13	-10.13	-10.13	0.0	0.0	0.0	10.13	10.13	10.13
5.00	0.9	0.9	2.9	2.3	4.4	2.3	3.1	1.6	1.6
10.00	4.5	4.5	8.1	6.2	13.8	6.2	9.2	6.8	6.8
15.00	14.8	14.8	20.2	17.5	21.8	17.5	24.1	18.6	18.6
20.00	25.9	25.8	29.5	28.7	28.5	28.7	36.2	30.6	30.6
25.00	36.3	36.2	38.5	42.2	44.1	42.2	45.7	41.5	41.5
30.00	45.7	45.6	48.3	53.1	57.7	53.1	52.7	50.7	50.7
35.00	56.9	56.9	59.4	62.4	66.4	62.4	61.0	59.3	59.3
40.00	65.4	65.4	68.5	69.9	71.3	69.9	68.5	66.5	66.5
45.00	72.1	72.1	74.1	74.2	76.1	74.2	73.9	72.1	72.1
50.00	76.2	76.2	77.3	76.9	78.9	76.9	77.4	76.2	76.2
55.00	79.1	79.1	79.9	79.6	80.4	79.6	80.1	79.1	79.1
60.00	81.1	81.1	81.5	81.5	81.6	81.5	81.7	81.3	81.3
65.00	82.7	82.7	82.9	83.0	83.2	83.0	83.0	82.8	82.8
70.00	83.9	83.9	84.1	84.4	84.5	84.4	84.2	84.1	84.1
75.00	85.3	85.3	85.5	85.7	85.7	85.7	85.5	85.3	85.3
80.00	86.4	86.4	86.5	86.6	86.9	86.6	86.6	86.4	86.4
85.00	87.3	87.3	87.6	87.5	87.8	87.5	87.6	87.3	87.3
90.00	88.1	88.1	88.4	88.2	88.4	88.2	88.4	88.1	88.1
95.00	88.9	88.9	88.9	88.9	89.0	88.9	89.0	88.9	88.9
100.00	89.5	89.5	89.5	89.5	89.6	89.5	89.6	89.5	89.5
105.00	90.0	90.0	90.1	90.1	90.1	90.1	90.1	90.1	90.1
110.00	90.5	90.5	90.6	90.7	90.7	90.7	90.7	90.6	90.6
115.00	91.1	91.1	91.1	91.1	91.3	91.1	91.1	91.1	91.1
120.00	91.5	91.5	91.6	91.6	91.7	91.6	91.6	91.5	91.5
125.00	91.9	91.9	92.0	92.0	92.0	92.0	92.0	91.9	91.9
130.00	92.3	92.3	92.3	92.3	92.4	92.3	92.4	92.3	92.3
135.00	92.7	92.7	92.6	92.6	92.7	92.6	92.6	92.6	92.6
140.00	93.0	93.0	93.1	93.1	92.9	93.1	93.0	93.0	93.0
145.00	93.4	93.4	93.4	93.4	93.3	93.4	93.3	93.3	93.3
150.00	93.7	93.7	93.7	93.7	93.8	93.7	93.7	93.6	93.6
155.00	94.0	94.0	94.0	94.0	94.1	94.0	94.0	94.0	94.0
160.00	94.3	94.3	94.3	94.3	94.3	94.3	94.3	94.3	94.3
165.00	94.6	94.6	94.6	94.6	94.6	94.6	94.6	94.6	94.6
170.00	94.8	94.8	94.8	94.9	94.9	94.9	94.8	94.8	94.8
175.00	95.1	95.1	95.1	95.1	95.0	95.1	95.1	95.1	95.1
180.00	95.4	95.4	95.4	95.4	95.4	95.4	95.4	95.4	95.4
184.99	95.6	95.6	95.6	95.6	95.6	95.6	95.6	95.6	95.6
189.99	95.8	95.8	95.9	95.8	95.9	95.8	95.9	95.8	95.8
194.99	96.0	96.0	96.1	96.1	96.1	96.1	96.1	96.1	96.1
199.99	96.3	96.3	96.3	96.3	96.3	96.3	96.3	96.4	96.4

Table A16

ENCIRCLED ENERGY

0.7 - 0.75 ARC SECOND CUBE

CIRCLE RADIUS (MICRONS)	PERCENT ENERGY WITHIN CIRCLE CENTERED AT INDICATED COORDINATES								
	CENTER (MICRONS): X=	-10.13	10.13	0.0	-10.13	0.0	10.13	0.0	-10.13	10.13
	Y=	-10.13	-10.13	-10.13	0.0	0.0	0.0	10.13	10.13	10.13
2.00		0.0	0.0	0.4	0.1	0.7	0.1	0.4	0.0	0.0
4.00		0.7	0.7	0.9	0.5	0.7	0.5	0.9	1.3	1.3
6.00		0.7	0.7	2.9	1.5	5.3	1.5	3.1	1.3	1.3
8.00		2.6	2.6	5.4	3.3	5.3	3.3	5.8	4.2	4.1
10.00		3.7	3.7	6.9	4.2	9.9	4.2	7.8	5.7	5.6
12.00		8.7	8.7	11.0	7.5	11.1	7.5	12.5	11.5	11.5
14.00		8.7	8.7	13.5	11.1	14.4	11.1	16.7	11.5	11.5
16.00		14.9	14.9	17.6	14.3	16.4	14.3	21.3	18.2	18.1
18.00		17.4	17.4	19.9	18.3	22.6	18.2	24.8	21.1	21.1
20.00		22.0	22.0	24.9	22.8	22.6	22.8	30.3	25.8	25.8
22.00		24.5	24.5	27.3	28.1	30.6	28.0	33.3	28.7	28.7
24.00		29.7	29.6	30.8	30.7	33.9	30.7	36.6	33.8	33.8
26.00		31.9	31.9	34.2	36.7	41.9	36.7	39.4	36.5	36.4
28.00		36.9	36.9	39.1	42.2	43.8	42.2	44.2	41.0	41.0
30.00		40.3	40.3	42.5	47.0	50.9	47.0	46.2	44.8	44.8
32.00		46.5	46.5	47.2	50.6	53.5	50.6	50.6	50.1	50.1
34.00		47.6	47.6	51.1	55.7	57.6	55.7	53.5	51.3	51.3
36.00		54.0	53.9	55.9	59.0	60.8	59.0	58.1	56.4	56.4
38.00		56.6	56.6	59.4	62.4	64.5	62.4	60.5	58.7	58.7
40.00		60.9	60.9	63.2	65.2	66.3	65.2	64.4	62.5	62.5
42.00		63.2	63.2	66.3	68.2	69.9	68.2	67.1	64.4	64.4
44.00		67.0	67.0	68.6	69.7	71.9	69.7	69.6	67.6	67.6
46.00		69.0	69.0	71.0	72.0	74.9	72.0	71.9	69.6	69.6
48.00		71.5	71.5	73.3	73.9	75.6	73.9	74.1	72.2	72.2
50.00		73.3	73.3	74.7	75.1	77.8	75.1	75.3	73.9	73.9
52.00		75.2	75.2	76.5	76.8	78.6	76.8	77.0	75.5	75.5
54.00		76.2	76.2	78.0	78.0	79.7	78.0	78.1	76.7	76.7
56.00		78.0	78.0	79.6	79.4	80.2	79.4	79.5	78.2	78.2
58.00		79.2	79.2	80.4	80.1	81.0	80.1	80.2	79.2	79.2
60.00		80.3	80.3	81.3	81.0	81.5	81.0	81.0	80.2	80.2
62.00		81.0	81.0	81.9	81.7	82.1	81.7	81.6	80.9	80.9
64.00		82.1	82.1	82.3	82.3	82.6	82.3	82.2	81.9	81.9
66.00		82.6	82.6	82.9	82.9	83.1	82.9	82.8	82.5	82.5
68.00		83.3	83.3	83.3	83.4	83.5	83.4	83.3	83.2	83.2
70.00		83.6	83.6	83.9	83.9	84.0	83.9	83.9	83.7	83.7
72.00		84.3	84.3	84.2	84.4	84.4	84.4	84.4	84.3	84.3
74.00		84.6	84.6	84.8	84.9	84.9	84.9	85.0	84.7	84.7
76.00		85.1	85.1	85.2	85.4	85.3	85.4	85.5	85.3	85.3
78.00		85.5	85.5	85.6	85.7	85.9	85.7	85.8	85.7	85.7
80.00		86.0	86.0	86.0	86.2	86.4	86.2	86.3	86.1	86.1

Table A17

ENCIRCLED ENERGY

0.75 ARC SECOND CUBE

CIRCLE RADIUS (MICRONS)	PERCENT ENERGY WITHIN CIRCLE CENTERED AT INDICATED COORDINATES								
	CENTER (MICRONS):								
	X= -10.13	10.13	0.0	-10.13	0.0	10.13	0.0	-10.13	10.13
	Y= -10.13	-10.13	-10.13	0.0	0.0	0.0	10.13	10.13	10.13
5.00	0.7	0.7	2.4	1.4	3.2	1.4	2.6	1.3	1.3
10.00	3.7	3.7	6.9	4.2	9.9	4.2	7.8	5.7	5.6
15.00	12.4	12.4	16.9	13.0	16.4	13.0	20.1	15.5	15.4
20.00	22.0	22.0	24.9	22.8	22.6	22.8	30.3	25.8	25.8
25.00	31.2	31.2	33.1	36.0	37.6	36.0	38.8	35.6	35.5
30.00	40.3	40.3	42.5	47.0	50.9	47.0	46.2	44.8	44.8
35.00	51.7	51.7	53.8	56.7	60.0	56.7	55.7	54.3	54.3
40.00	60.9	60.9	63.2	65.2	66.3	65.2	64.4	62.5	62.5
45.00	68.2	68.2	70.0	71.2	73.5	71.2	70.9	69.0	69.0
50.00	73.3	73.3	74.7	75.1	77.8	75.1	75.3	73.9	73.9
55.00	77.4	77.4	78.8	78.8	80.1	78.8	78.9	77.5	77.5
60.00	80.3	80.3	81.3	81.0	81.5	81.0	81.0	80.2	80.2
65.00	82.3	82.3	82.7	82.6	82.9	82.6	82.5	82.2	82.2
70.00	83.6	83.6	83.9	83.9	84.0	83.9	83.9	83.7	83.7
75.00	84.9	84.9	85.0	85.2	85.1	85.2	85.2	85.0	85.0
80.00	86.0	86.0	86.0	86.2	86.4	86.2	86.3	86.1	86.1
85.00	86.9	86.9	87.2	87.3	87.6	87.3	87.3	87.0	87.0
90.00	87.8	87.8	88.1	88.1	88.3	88.1	88.1	87.9	87.9
95.00	88.7	88.7	88.9	88.8	88.9	88.8	88.8	88.7	88.7
100.00	89.4	89.4	89.4	89.4	89.5	89.4	89.4	89.4	89.4
105.00	89.9	89.9	90.0	90.0	90.0	90.0	90.1	89.9	89.9
110.00	90.4	90.4	90.5	90.5	90.6	90.5	90.6	90.5	90.5
115.00	91.0	91.0	90.9	91.0	91.1	91.0	91.0	91.1	91.1
120.00	91.4	91.4	91.4	91.5	91.6	91.5	91.5	91.5	91.5
125.00	91.8	91.8	92.0	91.9	92.0	91.9	91.9	91.9	91.9
130.00	92.2	92.2	92.3	92.3	92.4	92.3	92.3	92.3	92.3
135.00	92.6	92.6	92.6	92.6	92.7	92.6	92.6	92.6	92.6
140.00	93.0	93.0	93.0	93.0	92.9	93.0	93.0	92.9	92.9
145.00	93.3	93.3	93.4	93.3	93.2	93.3	93.3	93.3	93.3
150.00	93.7	93.7	93.7	93.7	93.7	93.7	93.6	93.6	93.6
155.00	93.9	93.9	94.0	94.0	94.1	94.0	94.0	93.9	93.9
160.00	94.3	94.3	94.2	94.3	94.3	94.3	94.3	94.3	94.3
165.00	94.5	94.5	94.6	94.6	94.6	94.6	94.6	94.6	94.6
170.00	94.8	94.8	94.8	94.9	94.9	94.9	94.8	94.8	94.8
175.00	95.1	95.1	95.1	95.1	95.0	95.1	95.1	95.1	95.1
180.00	95.4	95.4	95.4	95.4	95.4	95.4	95.4	95.3	95.3
184.99	95.6	95.6	95.6	95.6	95.6	95.6	95.5	95.6	95.6
189.99	95.8	95.8	95.9	95.8	95.9	95.8	95.9	95.8	95.8
194.99	96.0	96.0	96.1	96.1	96.2	96.1	96.1	96.0	96.0
199.99	96.3	96.3	96.3	96.3	96.3	96.3	96.3	96.3	96.3

Figure A33

Wavefront Map - Q Polarization

Cube #1

MAP IN UNITS OF 0.01 WAVES

								43	38	34	29	25	24	28	34	37	41								
						48	50	48	44	39	33	27	24	25	29	34	38	40	42	42	43				
					48	49	49	45	41	38	32	25	21	23	27	31	35	38	37	41	40	38			
				44	48	49	49	43	40	37	28	22	18	16	24	27	33	36	35	38	39	38	36		
			37	41	45	44	40	38	35	32	24	18	11	12	16	22	24	30	30	34	35	37	34	31	
		32	34	36	37	37	31	28	27	21	16	13	3	3	15	18	20	23	25	27	30	31	28	24	23
	16	27	30	32	33	31	27	24	17	13	10	2	-3	-11	1	8	14	16	19	21	23	24	24	21	17	13
4	9	12	23	24	24	23	19	15	14	6	4	-2	-11	-10	-6	4	10	9	13	18	17	17	16	16	7	6	-1
0	-2	1	1	10	16	9	14	9	4	2	-4	-13	-16	-19	-13	-6	0	0	2	3	5	5	2	-2	-6	-4	-4
5	-2	-5	-11	-5	-6	0	0	-4	-8	-9	-17	-25	-28	-27	-23	-16	-10	-8	-4	-2	-1	-3	-9	-12	-12	-5	-3
6	4	0	-1	-11	-18	-15	-20	-20	-13	-14	-18	-27	-32	-36	-33	-30	-26	-21	-15	-11	-19	-17	-16	-16	-13	-9	-4	-2	0
11	6	4	-1	-7	-14	-24	-30	-33	-28	-24	-26	-36	-40	-47	-44	-38	-32	-31	-33	-31	-36	-29	-25	-19	-11	-2	0	4	6
12	11	6	1	-8	-13	-21	-32	-40	-46	-52	-48	-48	-52	-58	-62	-51	-50	-51	-55	-50	-43	-32	-23	-15	-9	-3	2	6	7
14	12	5	1	-7	-15	-19	-27	-42	-53	-62	-66	-70	-74	-78	-63	-71	-69	-73	-63	-50	-42	-32	-22	-12	-7	-1	7	11	9
13	10	6	2	-6	-15	-21	-31	-43	-53	-60	-73	-87	-95	-84	-92	-86	-85	-75	-63	-50	-41	-32	-19	-13	-7	0	6	11	12
12	11	6	0	-7	-13	-19	-32	-41	-50	-63	-75	-85	-86	-92	-84	-95	-87	-73	-60	-53	-43	-31	-21	-15	-6	2	6	10	13
9	11	7	1	-7	-12	-22	-32	-42	-50	-63	-73	-69	-71	-68	-78	-74	-70	-66	-62	-53	-42	-27	-19	-15	-7	1	5	12	14
7	6	2	-3	-9	-15	-23	-32	-43	-50	-55	-51	-50	-51	-62	-58	-52	-48	-48	-52	-45	-40	-32	-21	-13	-8	-1	6	11	12
6	4	0	-2	-11	-19	-25	-29	-36	-31	-33	-31	-52	-38	-44	-47	-40	-36	-26	-24	-28	-33	-30	-24	-14	-7	-1	4	6	11
0	-2	-4	-9	-13	-16	-16	-17	-19	-11	-15	-21	-26	-30	-33	-36	-32	-27	-18	-14	-13	-20	-20	-15	-18	-11	-1	0	4	6
-3	-5	-12	-12	-9	-3	-1	-2	-4	-8	-10	-16	-23	-27	-28	-25	-17	-9	-8	-4	0	0	-6	-5	-11	-5	-2	5		
-4	-4	-6	-2	-2	-5	-5	-3	-2	-0	0	-6	-13	-19	-16	-13	-4	2	4	9	14	9	16	10	1	1	-2	0		
-1	6	7	14	16	17	17	13	13	9	10	4	-6	-10	-11	-2	4	6	14	15	19	23	24	24	23	12	9	4		
	13	17	21	24	24	23	21	19	16	14	8	1	-11	-3	2	10	13	17	24	27	31	33	32	30	27	16			
		23	24	28	31	30	27	25	23	20	18	15	3	3	13	16	21	27	28	31	37	37	36	34	32				
			31	34	37	35	34	30	30	24	22	16	12	11	18	24	32	35	38	40	44	45	41	37					
				36	38	39	38	35	36	33	27	24	16	18	22	28	37	40	43	49	49	48	44						
					38	40	41	37	38	35	31	27	23	21	25	32	38	41	45	49	49	48							
						43	42	42	40	39	34	29	25	24	27	33	39	44	48	50	48							
								41	37	34	29	24	25	29	34	38	43											

Figure A34

Wavefront Plot - Q Polarization

Cube #1

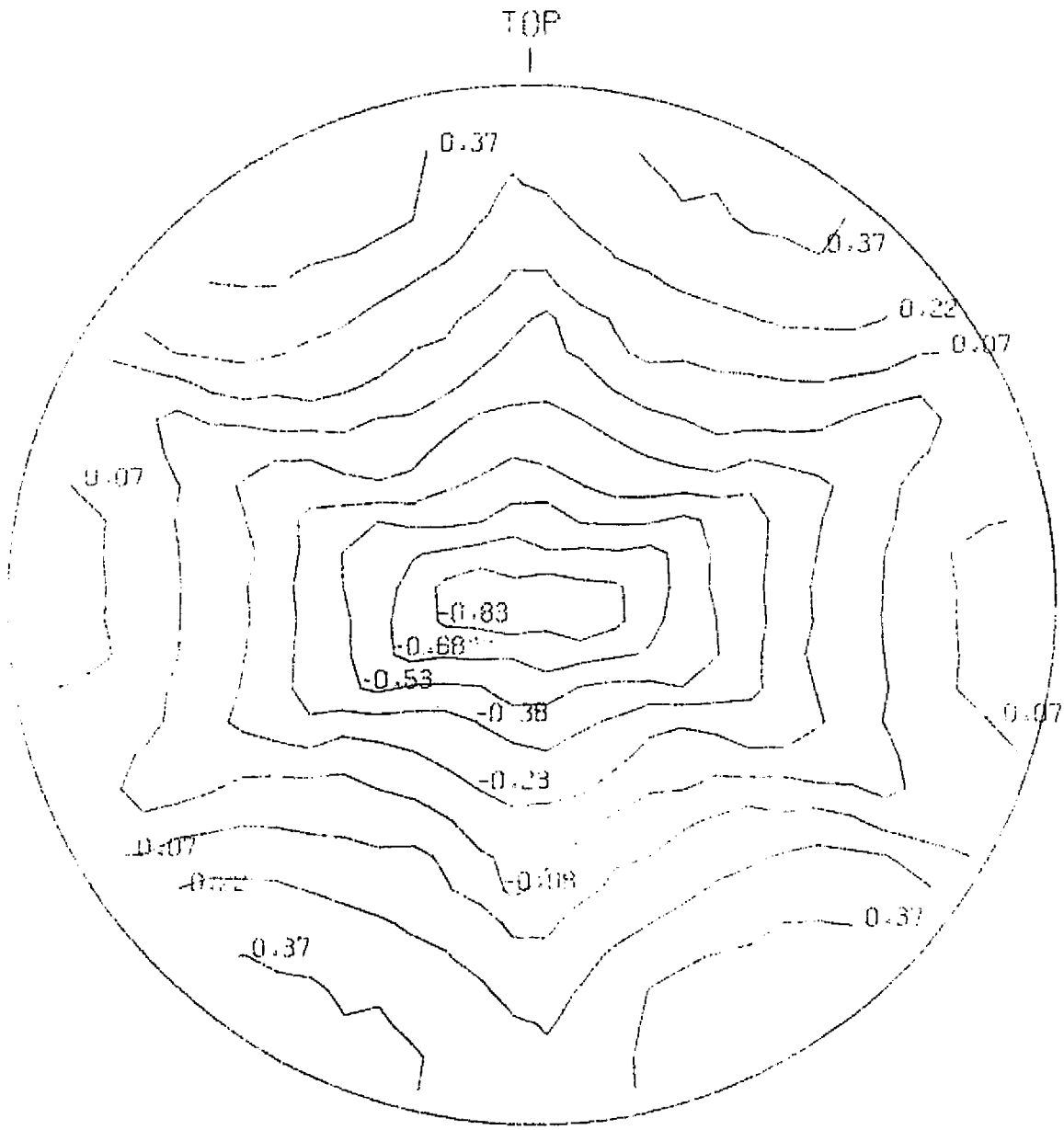


Figure A35

Wavefront Map - P Polarization

Cube #1

MAP IN UNITS OF 0.01 WAVES

								101	97	93	87	83	33	37	42	46	49								
						107	109	106	103	98	92	86	82	33	38	43	46	48	51	51	52				
					107	109	107	103	99	97	90	83	79	32	36	40	43	46	46	49	49	46			
				102	107	108	107	102	98	95	86	81	77	25	33	35	41	44	43	47	47	46	45		
			96	100	103	107	99	96	93	90	83	76	69	20	25	31	33	39	39	42	43	45	43	40	
		90	93	95	95	95	89	87	86	79	75	72	62	11	23	27	28	31	34	35	38	40	37	33	32
	74	85	88	90	92	90	85	82	75	72	68	60	55	-2	9	16	22	25	27	30	32	32	33	30	25	22
20	68	71	81	83	83	81	78	73	72	65	63	55	47	-1	2	13	18	17	21	22	26	25	24	25	16	15	-35
16	13	17	60	69	74	68	72	68	62	60	54	45	42	-10	-5	2	7	8	10	11	13	14	10	6	-40	-38	-38
21	13	10	4	-62	-52	-58	-57	-54	-49	-48	-40	-33	-29	-18	-14	-8	-2	0	-3	5	-6	4	-1	-46	-46	-39	-37
22	20	16	14	4	-2	0	37	38	44	43	39	31	25	21	-25	-22	-18	-13	-7	-3	-11	-9	-50	-50	-47	-43	-38	-36	-34
27	22	20	14	8	1	-8	-14	-17	30	33	31	22	18	11	-36	-30	-23	-23	-25	-23	-70	-63	-59	-53	-45	-36	-34	-29	-27
29	27	22	14	7	2	5	-16	-24	-25	-36	9	10	6	0	-53	-42	-41	-42	-89	-84	-77	-66	-57	-49	-43	-37	-31	-27	-24
30	28	21	17	8	0	-3	-11	-26	-37	-46	-50	-11	-15	-19	-60	-62	-61	-107	-97	-84	-76	-66	-56	-46	-41	-35	-26	-22	-24
29	26	22	19	9	0	-5	-15	-27	-37	-44	-57	-71	-79	-26	-84	-120	-119	-109	-97	-84	-75	-66	-53	-47	-41	-34	-27	-22	-21
28	27	22	15	8	2	3	16	25	34	47	59	69	70	72	14	129	121	107	94	87	77	65	55	49	40	31	27	23	20
25	27	23	14	38	3	-6	-16	-26	-34	-47	-57	-49	-51	-48	-7	-3	0	100	96	87	76	61	53	49	41	32	28	21	19
23	22	18	12	6	0	-7	-16	-27	-34	-39	-31	-30	-30	-41	11	18	21	21	86	79	74	66	55	47	42	35	27	22	21
22	20	15	13	4	3	9	13	20	11	13	11	12	18	24	22	29	33	43	45	41	67	64	58	48	41	35	29	27	22
15	13	11	6	2	0	1	2	0	8	4	-1	-6	-10	-13	33	37	43	51	55	56	49	49	49	52	45	35	33	29	27
12	10	3	3	10	16	19	17	15	12	9	3	-3	-6	41	44	52	60	61	66	69	69	64	64	45	39	36	28		
11	11	9	17	22	25	25	23	22	20	19	13	6	0	54	57	65	72	74	80	84	80	86	80	72	32	36	33		
14	26	27	36	36	37	37	34	33	29	30	24	13	9	58	67	74	76	84	85	89	93	95	95	93	82	79	29		
	33	37	41	45	44	43	41	39	36	34	28	21	8	66	72	80	83	87	94	97	102	104	102	100	97	86			
		43	45	48	51	50	47	45	43	40	38	35	23	73	83	87	91	57	98	101	107	107	106	104	102				
			52	54	57	55	54	51	50	45	42	37	32	81	88	94	102	105	108	110	115	115	111	108					
				56	58	59	58	55	56	53	47	44	36	88	92	98	107	110	113	119	119	118	114						
					58	60	61	57	59	55	51	47	44	91	95	102	108	111	115	119	119	119							
						63	62	62	60	58	54	49	45	94	97	103	109	114	118	120	118							
								61	57	54	48	44	95	99	104	108	113											

Figure A36

Wavefront Plot - P Polarization

Cube #1

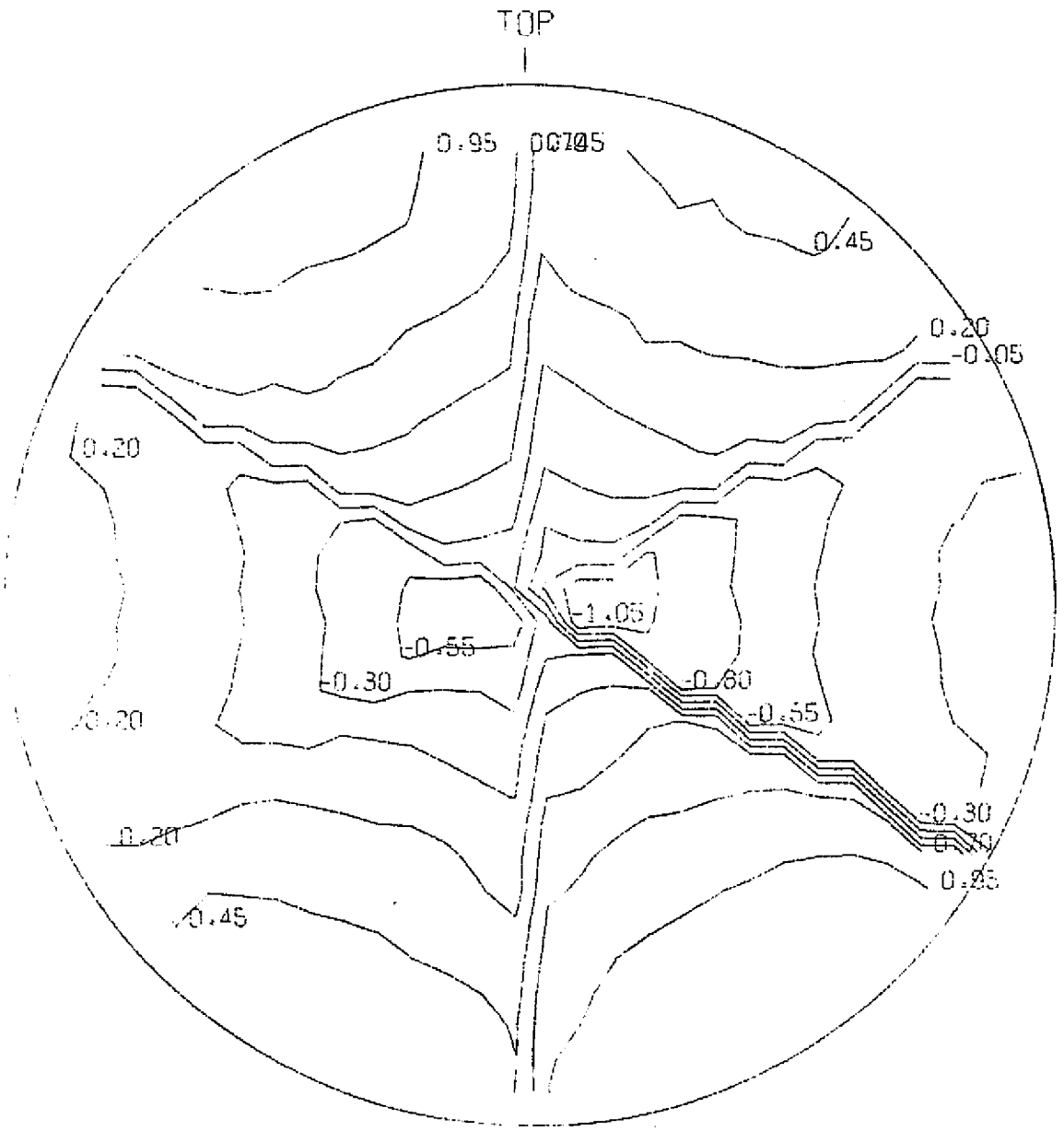


Figure A37

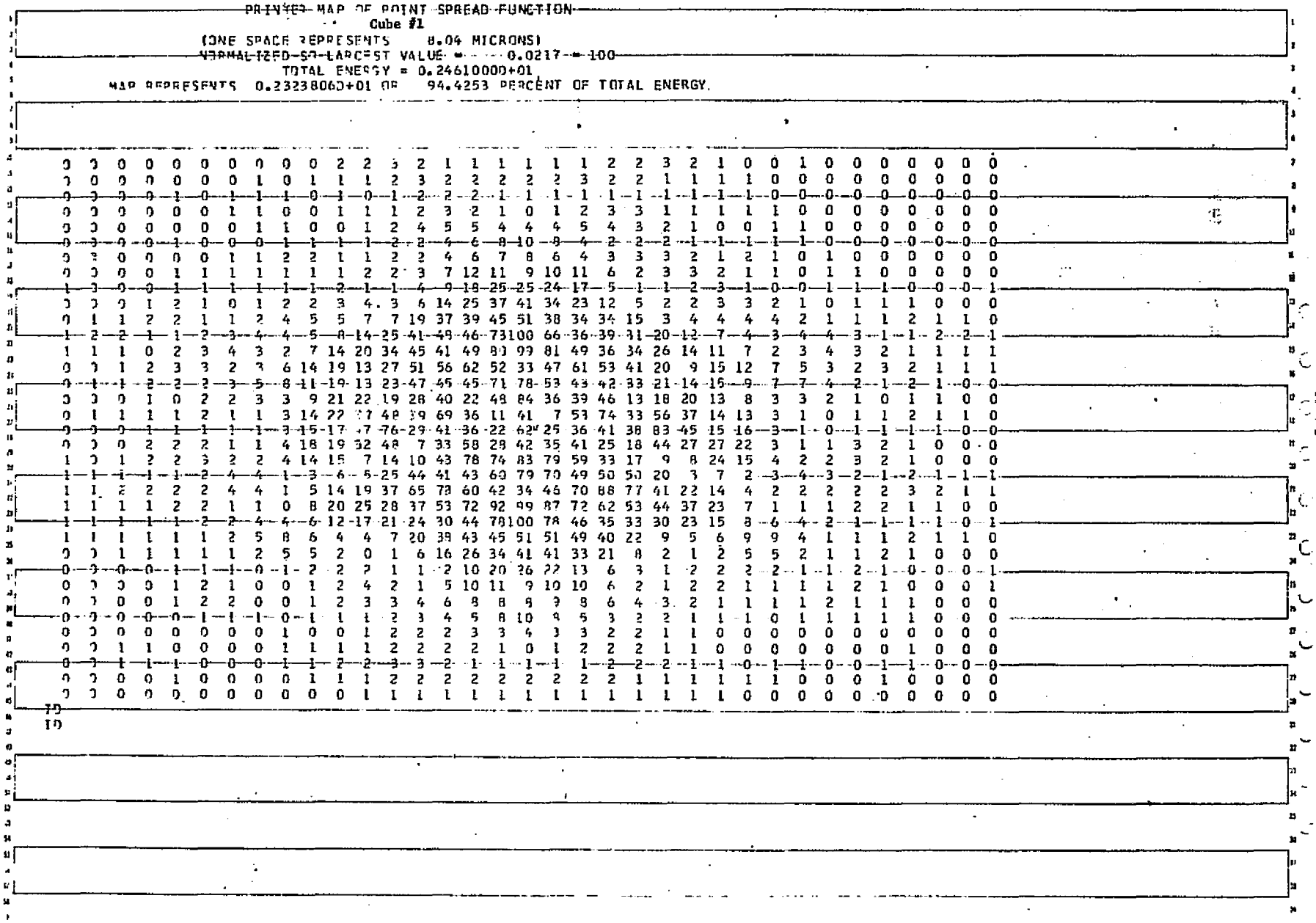

PRINTED MAP OF POINT SPREAD FUNCTION
Cube #1
(ONE SPACE REPRESENTS 8.04 MICRONS)
NORMALIZED SO LARGEST VALUE = 0.0217 = 100
TOTAL ENERGY = 0.24610000+01
MAP REPRESENTS 0.23238060+01 OR 94.4253 PERCENT OF TOTAL ENERGY.

Figure A38

Point Spread Function

Cube #1

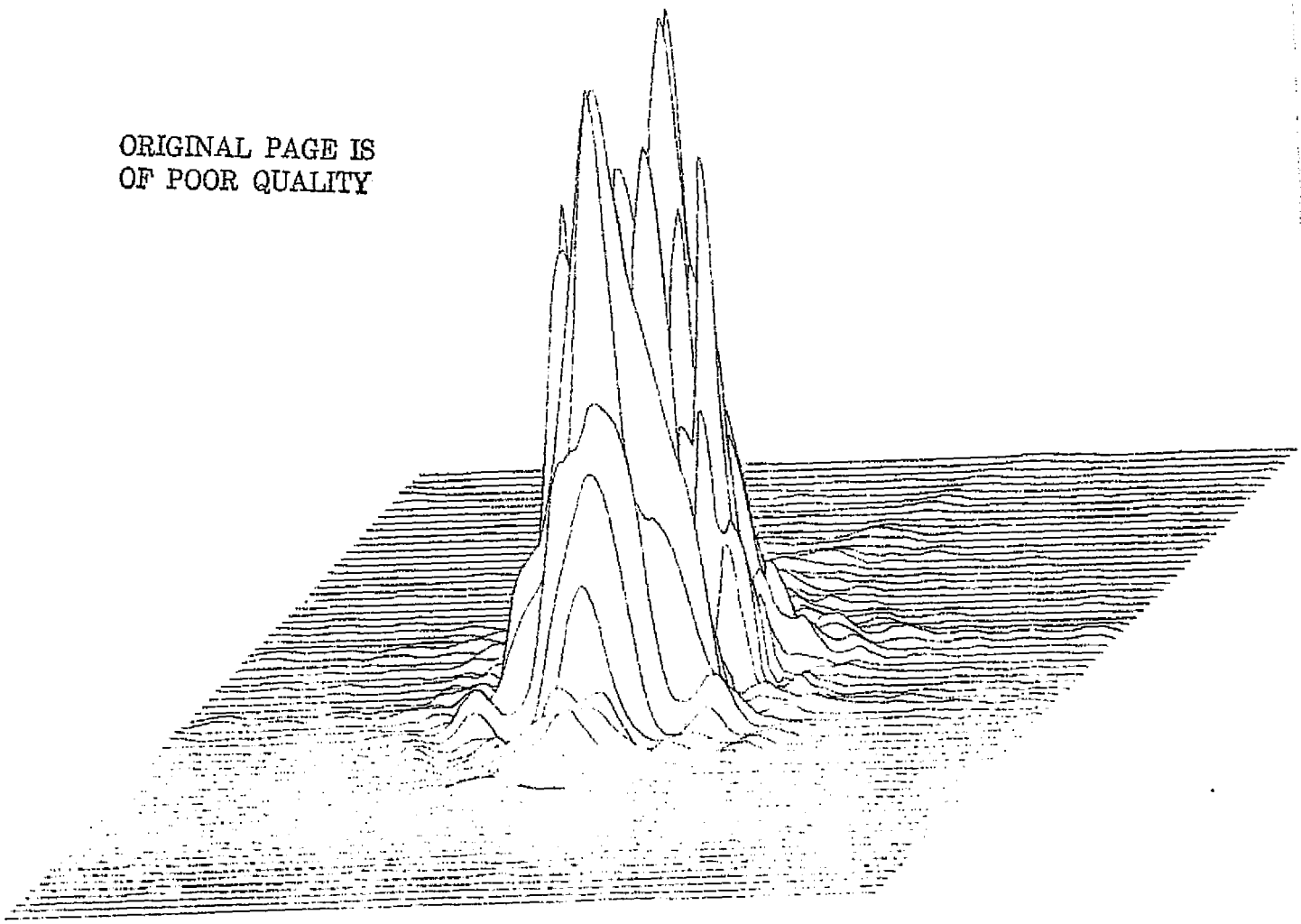


Figure A39

Intensity Distribution - Central 129 Microradians

Cube #1

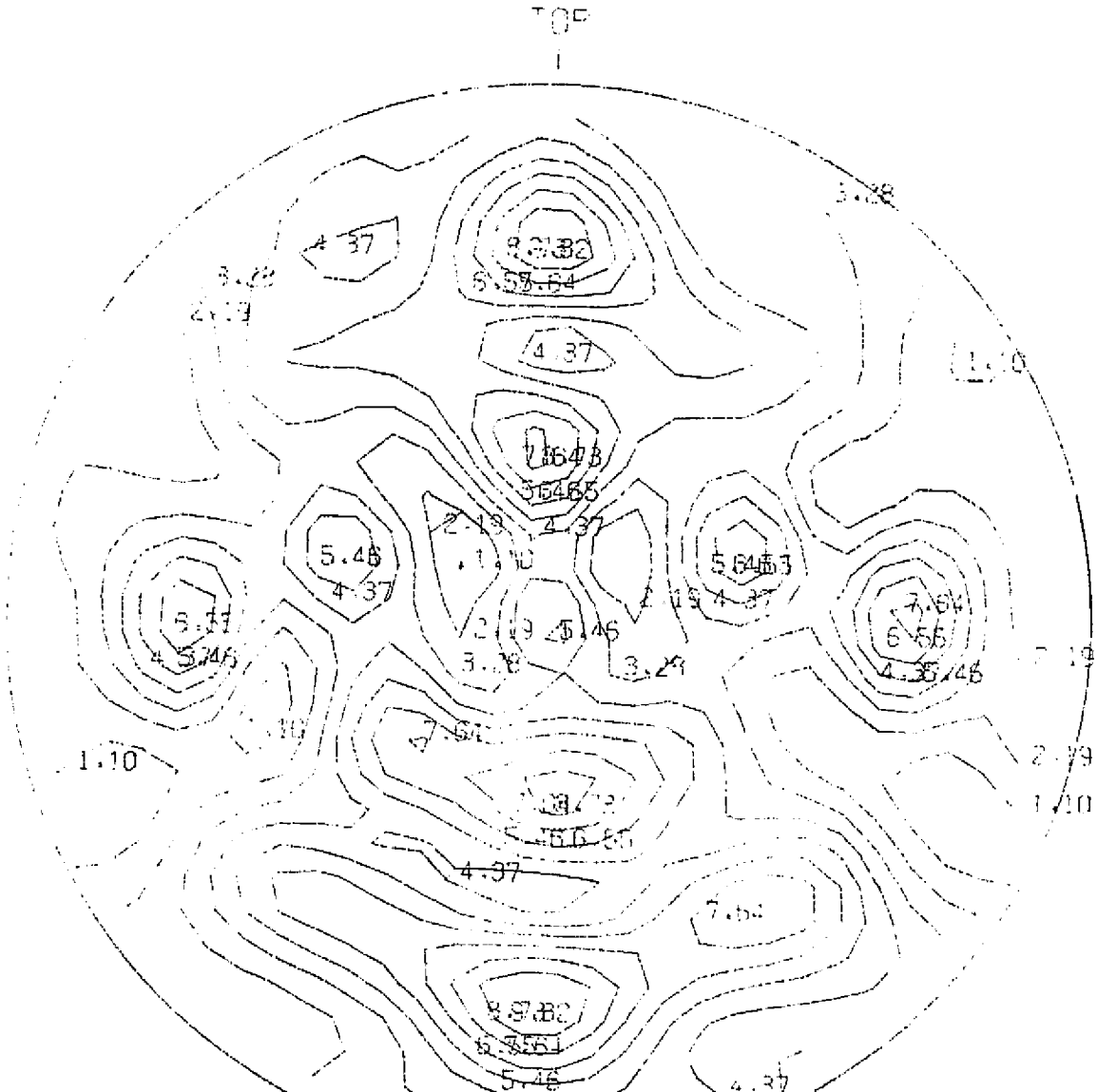


Figure A40

Encircled Energy
Vs
Field Angle

Cube #1

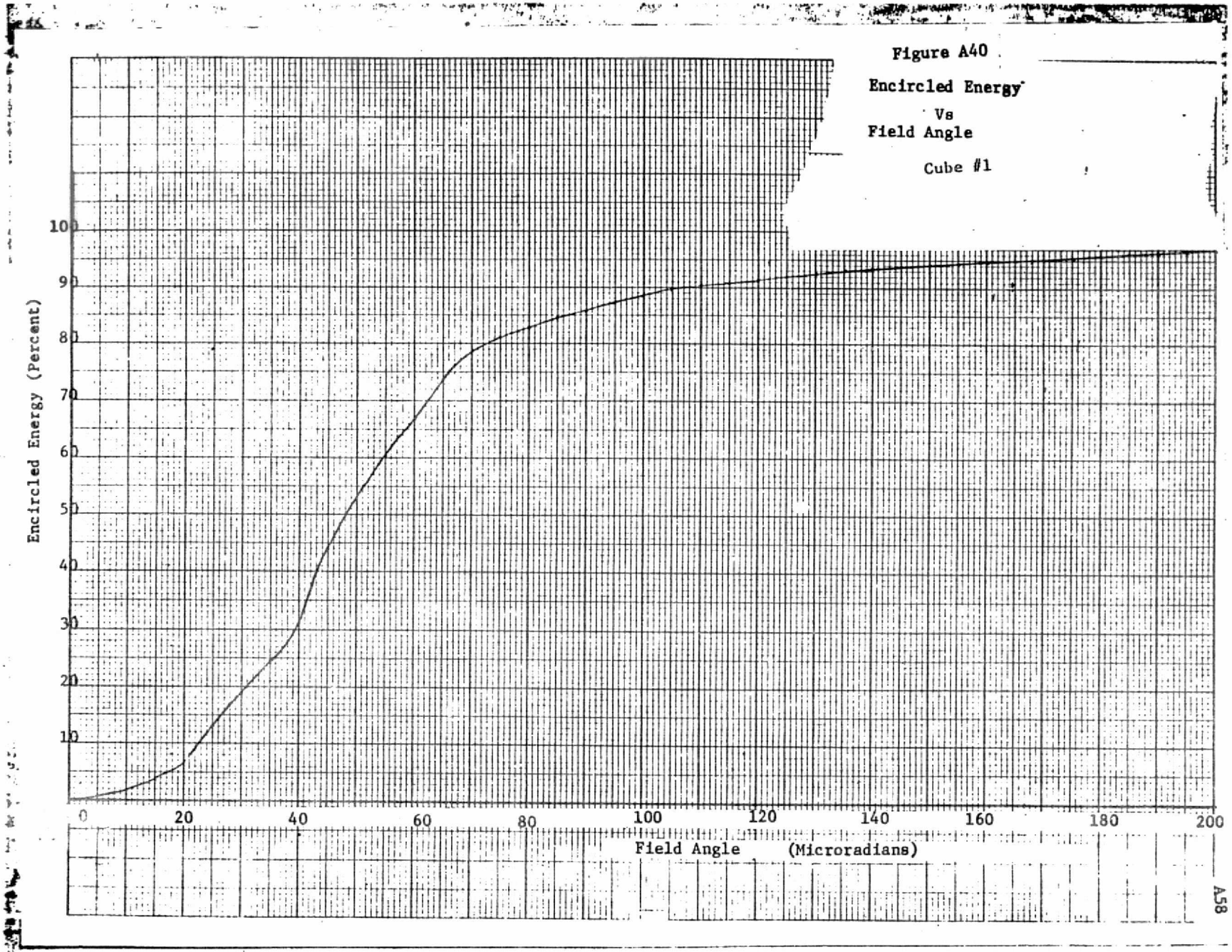


Table A18

ENCIRCLED ENERGY

Cube #1

CIRCLE RADIUS (MICRONS)	PERCENT ENERGY WITHIN CIRCLE CENTERED AT INDICATED COORDINATES								
	CENTER (MICRONS):								
	X= -10.13	10.13	0.0	-10.13	0.0	10.13	0.0	-10.13	10.13
	Y= -10.13	-10.13	-10.13	0.0	0.0	0.0	10.13	10.13	10.13
2.00	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.0	0.0
4.00	0.2	0.2	0.2	0.1	0.1	0.1	0.2	0.4	0.4
6.00	0.2	0.2	0.7	0.4	0.9	0.4	0.8	0.4	0.4
8.00	0.7	0.7	1.3	0.8	0.9	0.8	1.5	1.3	1.3
10.00	1.1	1.1	1.6	1.1	1.6	1.2	2.0	1.9	1.8
12.00	2.8	2.9	2.6	2.0	1.8	2.1	3.2	3.8	3.6
14.00	2.8	2.9	3.3	3.3	2.8	3.3	4.6	3.8	3.6
16.00	5.0	5.2	4.4	4.3	3.4	4.3	5.8	5.9	5.6
18.00	5.9	6.1	5.5	5.8	6.3	5.7	7.1	6.9	6.6
20.00	7.7	7.8	7.1	7.4	6.3	7.3	8.6	8.5	8.3
22.00	8.5	8.6	8.8	9.3	10.0	9.2	10.1	9.3	9.2
24.00	10.8	10.7	10.3	10.5	11.4	10.4	11.4	11.4	11.5
26.00	11.8	11.7	12.6	12.7	14.8	12.6	13.1	12.5	12.8
28.00	14.9	14.6	15.9	15.4	15.7	15.5	16.3	15.4	15.9
30.00	17.0	16.6	18.0	17.5	18.6	17.5	18.0	17.6	18.2
32.00	21.4	20.9	21.2	19.9	20.1	20.1	21.3	21.8	22.5
34.00	22.4	21.9	23.7	22.8	22.3	23.0	24.0	22.8	23.5
36.00	27.0	26.6	26.9	25.5	24.9	25.7	27.8	27.4	28.0
38.00	29.1	28.7	29.4	28.5	29.1	28.7	30.5	29.7	30.2
40.00	32.8	32.4	32.5	31.3	31.1	31.5	34.2	33.5	34.0
42.00	34.6	34.2	35.8	35.5	37.1	35.5	37.7	35.4	35.8
44.00	38.3	38.0	38.4	37.6	39.7	37.6	40.6	39.3	39.6
46.00	40.7	40.4	41.9	42.4	45.9	42.3	44.0	42.0	42.2
48.00	44.3	43.9	45.9	46.0	47.1	45.9	47.9	45.6	45.9
50.00	47.1	46.7	48.4	49.3	52.6	49.2	50.1	48.6	48.8
52.00	51.0	50.5	52.5	53.0	54.6	52.9	53.9	52.3	52.6
54.00	53.2	52.8	55.3	56.5	58.5	56.3	56.4	54.5	54.7
56.00	57.3	57.0	59.6	60.1	60.5	60.0	60.5	58.4	58.6
58.00	60.1	59.9	61.6	62.5	64.3	62.4	62.5	61.1	61.2
60.00	63.2	63.1	65.0	65.4	66.6	65.5	65.8	64.1	64.1
62.00	65.2	65.2	67.0	68.3	69.6	68.3	67.9	66.1	66.0
64.00	68.3	68.6	69.4	70.0	71.9	70.1	70.3	69.2	68.9
66.00	70.1	70.3	71.5	72.9	74.8	72.9	72.5	70.9	70.6
68.00	72.4	72.9	73.7	74.4	75.9	74.4	74.4	73.3	73.0
70.00	73.8	74.1	75.4	76.4	78.2	76.5	75.9	74.6	74.3
72.00	76.0	76.4	77.2	77.7	79.4	77.3	77.5	76.7	76.4
74.00	77.1	77.4	78.8	79.4	80.7	79.4	78.8	77.6	77.4
76.00	79.0	79.3	80.4	80.6	81.4	80.5	80.2	79.4	79.2
78.00	80.2	80.4	81.1	81.6	82.3	81.6	80.8	80.3	80.2
80.00	81.5	81.7	82.4	82.4	82.9	82.5	82.1	81.7	81.5

Table A19

ENCIRCLED ENERGY

Cube #1

CIRCLE RADIUS (MICRONS)	PERCENT ENERGY WITHIN CIRCLE CENTERED AT INDICATED COORDINATES CENTER (MICRONS):								
	X= -10.13	10.13	0.0	-10.13	0.0	10.13	0.0	-10.13	10.13
	Y= 10.13	10.13	10.13	0.0	0.0	0.0	-10.13	-10.13	-10.13
5.00	0.2	0.2	0.5	0.3	0.6	0.3	0.6	0.4	0.4
10.00	1.1	1.1	1.6	1.1	1.6	1.2	2.0	1.9	1.8
15.00	4.1	4.3	4.1	3.8	3.4	3.8	5.4	5.0	4.3
20.00	7.7	7.8	7.1	7.4	6.3	7.3	8.6	8.5	8.3
25.00	11.5	11.4	12.1	12.4	13.0	12.4	12.8	12.1	12.4
30.00	17.0	16.6	18.0	17.5	13.6	17.5	18.0	17.6	18.2
35.00	25.2	24.8	25.4	23.8	24.2	24.0	25.7	25.5	26.1
40.00	32.8	32.4	32.5	31.3	31.1	31.5	34.2	33.5	34.0
45.00	39.7	39.3	40.3	40.8	43.7	40.7	42.5	40.8	41.1
50.00	47.1	46.7	48.4	49.3	52.6	49.2	50.1	48.6	48.8
55.00	55.9	55.5	57.9	58.4	60.1	58.3	59.0	56.9	57.2
60.00	63.7	63.1	65.0	65.4	66.6	65.5	65.8	64.1	64.1
65.00	69.1	69.4	70.7	71.7	73.7	71.8	71.6	70.0	69.7
70.00	73.8	74.1	75.4	76.4	78.2	76.5	75.9	74.6	74.3
75.00	78.2	78.5	79.6	80.0	81.1	80.0	79.6	78.6	78.4
80.00	81.5	81.7	82.4	82.4	82.9	82.5	82.1	81.7	81.5
85.00	83.6	83.8	84.2	84.3	84.3	84.3	84.2	83.8	83.7
90.00	85.3	85.4	85.5	85.7	85.8	85.8	85.8	85.6	85.4
95.00	86.7	86.8	86.8	87.0	87.2	87.0	87.1	87.0	86.9
100.00	87.9	87.9	88.0	88.2	88.5	88.2	88.2	88.0	88.0
105.00	88.9	88.9	89.2	89.3	89.5	89.3	89.1	88.9	89.0
110.00	90.0	89.9	90.1	90.1	90.3	90.1	89.9	89.8	89.8
115.00	90.8	90.7	90.8	90.8	90.9	90.8	90.7	90.7	90.7
120.00	91.4	91.4	91.5	91.4	91.4	91.4	91.5	91.4	91.3
125.00	91.9	91.9	92.0	92.0	92.0	91.9	92.1	92.0	91.9
130.00	92.5	92.5	92.5	92.5	92.6	92.5	92.6	92.5	92.5
135.00	92.9	92.9	93.0	93.0	93.2	93.0	93.0	93.0	92.9
140.00	93.3	93.4	93.4	93.5	93.5	93.5	93.5	93.5	93.4
145.00	93.7	93.7	93.7	93.9	93.8	93.9	93.9	93.8	93.8
150.00	94.1	94.0	94.1	94.2	94.2	94.2	94.2	94.2	94.2
155.00	94.4	94.4	94.5	94.5	94.5	94.5	94.5	94.4	94.5
160.00	94.7	94.7	94.7	94.7	94.7	94.7	94.7	94.8	94.8
165.00	95.0	95.0	95.0	95.0	95.0	95.0	95.0	95.0	95.0
170.00	95.2	95.3	95.3	95.3	95.3	95.3	95.3	95.3	95.3
175.00	95.5	95.5	95.5	95.6	95.6	95.6	95.6	95.6	95.5
180.00	95.8	95.8	95.8	95.8	95.9	95.8	95.9	95.8	95.8
184.99	96.0	96.0	96.0	96.0	96.1	96.1	96.1	96.1	96.1
189.99	96.2	96.2	96.3	96.3	96.3	96.3	96.3	96.3	96.3
194.99	96.4	96.4	96.4	96.5	96.5	96.5	96.5	96.5	96.5
199.99	96.7	96.7	96.6	96.7	96.7	96.7	96.7	96.7	96.7

Figure A41

Wavefront Map - Q Polarization

Cube #2

MAP IN UNITS OF 0.01 WAVES

								49	43	38	32	30	31	36	41	45	48									
						50	50	47	45	41	32	30	27	27	32	40	43	45	49	50	47					
					47	46	44	43	40	35	31	27	25	23	29	33	40	43	44	46	44	44				
				43	43	44	41	38	36	29	27	21	16	20	25	28	35	39	40	42	43	43	43			
			38	38	38	37	37	33	30	25	20	15	12	15	22	24	27	33	36	39	39	40	41	40		
		29	28	29	31	28	29	25	21	20	17	12	8	7	15	15	23	24	29	32	33	34	38	36	34	
	23	24	22	25	25	22	18	15	11	8	5	-1	-4	-2	3	12	15	18	23	27	28	29	34	34	33	30
9	9	12	17	19	18	16	13	11	7	0	-3	-6	-9	-8	-6	7	9	13	16	20	23	25	27	27	22	20	16
2	-2	-3	1	5	14	10	5	3	0	-4	-9	-13	-17	-15	-10	0	2	3	7	10	11	13	3	0	8	3	5
1	3	-10	-13	-10	-7	-6	-9	-7	-13	-18	-18	-23	-24	-24	-22	-18	-9	-5	-1	0	-1	-7	-5	-12	-6	-2	0
11	5	-1	-8	-11	-19	-18	-24	-23	-18	-23	-24	-30	-38	-43	-37	-30	-24	-19	-14	-13	-8	-15	-22	-18	-8	-2	2	6	9
12	10	1	-3	-10	-17	-26	-32	-36	-28	-29	-35	-38	-43	-49	-49	-37	-33	-30	-33	-27	-30	-31	-22	-17	-8	0	5	10	13
1	10	2	0	-8	-15	-24	-34	-40	-42	-50	-52	-51	-57	-58	-58	-50	-47	-51	-57	-50	-40	-34	-23	-12	-5	-2	7	12	16
15	12	5	9	-6	-13	-20	-29	-42	-53	-65	-69	-84	-77	-79	-70	-71	-77	-67	-58	-52	-41	-33	-24	-15	-7	2	10	12	17
17	14	7	0	-5	-14	-19	-31	-42	-58	-66	-71	-83	-103	-105	-102	-99	-92	-77	-65	-52	-41	-29	-22	-17	-5	4	8	15	18
18	15	8	4	-5	-17	-22	-29	-41	-52	-65	-77	-92	-99	-102	-105	-103	-83	-71	-65	-58	-42	-31	-19	-14	-5	0	7	14	17
17	12	10	2	-7	-15	-24	-33	-41	-52	-58	-67	-77	-71	-70	-79	-77	-84	-69	-65	-53	-42	-29	-20	-13	-6	0	5	12	15
16	12	7	2	-5	-12	-23	-34	-40	-50	-57	-51	-47	-50	-58	-58	-57	-51	-52	-50	-42	-40	-34	-24	-15	-8	0	2	10	14
13	10	5	0	-8	-17	-22	-31	-30	-27	-33	-30	-33	-37	-49	-49	-43	-38	-35	-29	-28	-36	-32	-26	-17	-10	-3	1	10	12
9	6	2	-2	-8	-18	-22	-15	-8	-13	-14	-19	-24	-30	-37	-43	-38	-30	-24	-23	-18	-23	-24	-18	-19	-11	-8	-1	5	11
	0	2	-6	-12	-5	-7	-1	0	-1	-5	-9	-18	-22	-24	-24	-23	-18	-18	-13	-7	-8	-6	-7	-10	-13	-10	-3	1	
	5	3	-8	-0	3	-13	-11	-10	-7	-3	-2	-0	-10	-15	-17	-13	-9	-4	-0	-3	-5	-10	-14	-5	-1	-3	-2	-2	
	16	20	22	27	27	25	23	20	16	13	9	7	-6	-8	-9	-6	-3	0	7	11	13	16	18	19	17	12	9	9	
		30	33	34	34	29	28	27	23	18	15	12	3	-2	-4	-1	5	8	11	15	18	22	2"	25	22	24	23		
			34	36	38	34	33	32	29	24	23	19	15	7	8	12	17	20	21	25	29	28	31	29	28	29			
				40	41	40	39	39	36	33	27	24	22	19	12	15	20	25	30	33	37	37	38	38	38			
					43	43	43	42	40	39	35	28	25	20	16	21	27	29	36	38	41	44	43	43				
						44	44	45	44	43	43	33	29	23	25	27	31	35	40	43	44	45	47					
							47	50	49	45	43	40	32	27	27	30	37	41	45	47	50	50						
									48	46	41	36	31	30	32	38	43	49										

Figure A42

Wavefront Plot - Q Polarization

Cube #2

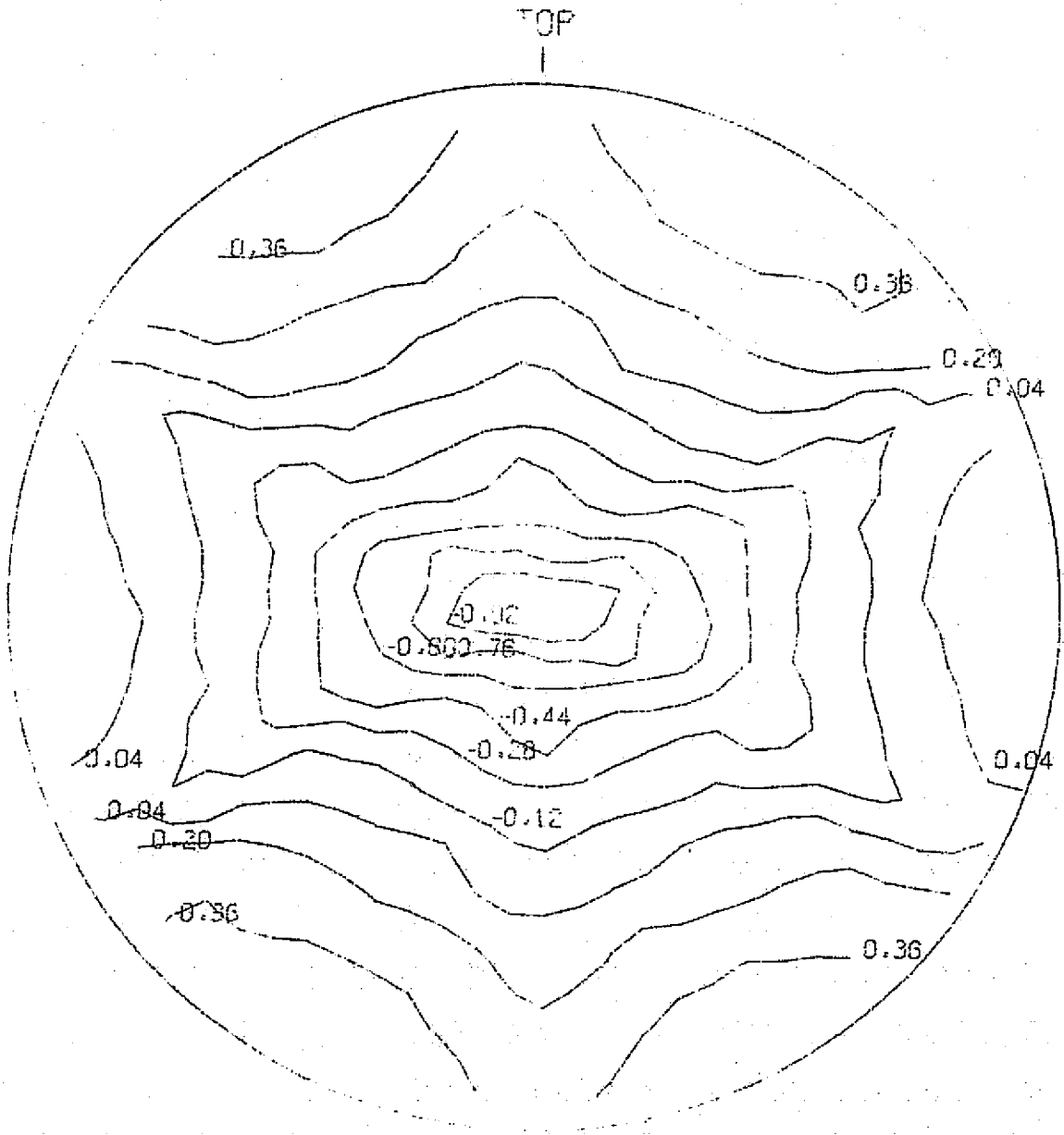


Figure A43

Wavefront Map - P Polarization

Cube #2

MAP IN UNITS OF 0.01 WAVES

108 102 97 91 89 39 45 50 54 56

109 103 105 104 100 91 89 86 36 40 49 52 54 58 58 55

105 104 102 101 98 94 93 86 84 32 37 41 48 51 52 54 53 52

101 101 102 99 96 94 87 85 80 75 29 33 37 44 47 49 51 51 52 52

96 97 95 96 95 91 88 84 79 73 71 24 30 33 36 42 45 47 48 49 50 48

88 87 88 90 87 87 84 80 78 76 70 66 16 24 28 31 32 37 41 41 43 46 44 42

81 83 80 83 83 81 77 73 69 67 63 57 53 5 11 21 23 26 31 35 36 38 43 42 42 39

25 68 70 76 78 77 74 72 69 66 59 55 51 48 0 1 16 17 21 24 28 31 33 36 36 30 29 -17

18 13 12 60 63 72 69 64 61 58 54 48 45 40 -6 -1 7 10 12 15 19 19 22 11 8 -25 -30 -28

17 12 5 2 47 51 52 53 50 44 39 39 35 33 16 13 9 1 3 6 8 7 1 2 46 40 31 33

27 21 14 7 4 -3 -2 34 35 40 34 33 28 19 15 -29 -22 -16 -11 -5 -4 0 -7 -56 -52 -42 -36 -31 -27 -24

28 26 17 12 5 -1 -10 -16 -20 29 29 72 19 15 8 -40 -29 -25 -22 -25 -19 -64 -65 -56 -51 -42 -34 -28 -23 -20

30 26 18 15 7 0 -8 -18 -24 -26 -34 -5 -7 -1 -0 -50 -42 -38 -42 -91 -84 -74 -68 -57 -46 -39 -31 -26 -21 -17

31 28 21 16 9 2 -4 -13 -26 -37 -49 -53 -25 -19 -20 -61 -62 -68 -101 -92 -86 -75 -67 -58 -49 -41 -31 -23 -21 -16

33 30 23 16 10 1 -3 -15 -26 -42 -49 -55 -67 -87 -47 -94 -133 -126 -111 -99 -86 -75 -63 -56 -51 -39 -29 -25 -18 -15

34 31 24 20 10 1 -6 -13 -25 -36 -49 -61 -76 -83 -82 -35 -137 -117 -105 -99 -92 -76 -65 -53 -48 -39 -33 -26 -19 -16

33 28 26 18 8 0 -8 -17 -25 -36 -42 -51 -57 -51 -49 -9 -7 -13 -103 -99 -87 -76 -63 -54 -47 -40 -33 -28 -21 -18

32 28 23 18 10 3 -7 -18 -24 -34 -41 -31 -26 -33 -38 12 12 19 17 -84 -76 -74 -68 -58 -49 -42 -34 -31 -23 -19

29 26 21 15 7 -1 -6 -15 -14 -7 -13 -10 -13 -17 -29 -20 -26 -31 -34 -40 -41 -70 -66 -60 -51 -44 -37 -32 -23 -21

25 22 18 13 7 -2 -6 4 11 6 5 0 -4 -10 -17 26 31 40 45 46 52 47 46 -52 -53 -45 -42 -35 -28 -22

16 18 9 3 14 12 18 20 18 15 10 1 -2 -4 45 46 51 51 56 62 61 64 62 59 -47 -44 -37 -32

21 19 24 20 23 33 31 30 27 23 22 19 9 4 52 57 60 65 70 73 75 80 84 75 71 37 35 31

32 40 42 47 47 45 43 40 36 33 29 27 13 12 60 63 66 71 77 81 83 86 88 89 88 82 83 -24

50 53 54 54 49 48 47 43 38 35 32 23 17 65 68 75 79 81 85 89 93 95 95 92 94 93

54 56 58 54 53 52 49 44 43 39 35 27 78 82 88 90 91 96 99 99 101 100 98 100

60 61 60 59 59 56 53 47 44 42 35 82 85 91 95 100 103 107 107 108 108 108

64 63 63 62 60 59 56 48 45 41 86 91 97 99 104 108 111 114 113 113

64 64 65 64 63 60 53 49 43 95 98 102 105 110 113 114 116 117

67 70 70 65 63 60 52 47 98 101 102 111 116 117 120 120

68 65 61 57 51 101 102 109 114 119

Figure A44

Wavefront Plot - P Polarization

Cube #2

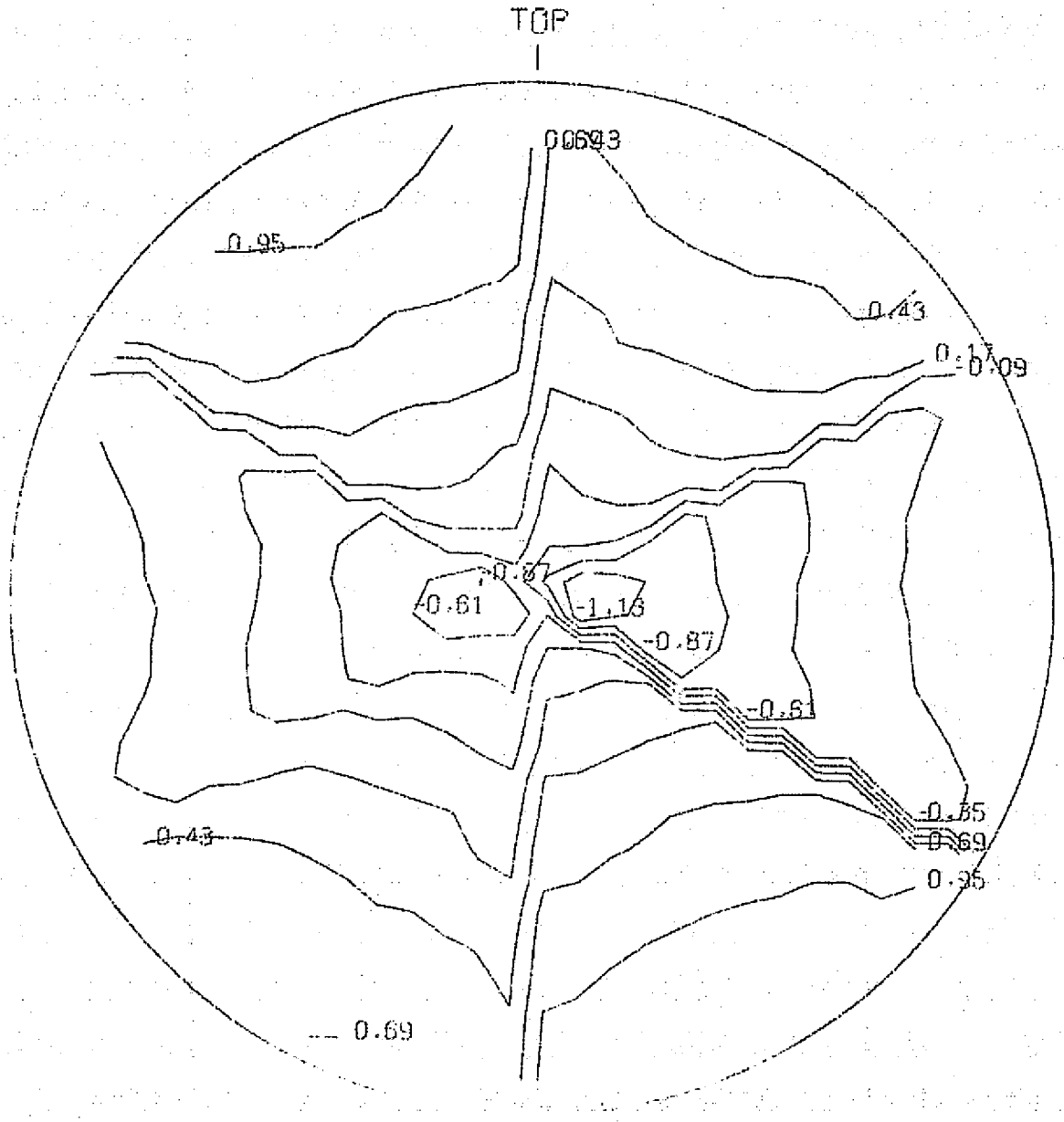


Figure A45

PRINTER MAP OF POINT SPREAD FUNCTION
Cube #2
(ONE SPACE REPRESENTS 8.04 MICRONS)
NORMALIZED SO LARGEST VALUE = 9.9198 = 100
TOTAL ENERGY = 0.2461000D+01
MAP REPRESENTS 0.2309027D+01 OR 93.8247 PERCENT OF TOTAL ENERGY

```
 0  0  0  0  0  0  0  1  1  0  1  2  3  3  3  2  1  0  1  2  3  3  3  2  1  0  0  0  0  0  0  0  0  0  0
 0  0  0  0  0  0  0  1  1  1  2  1  2  3  5  4  2  1  2  4  4  3  2  1  1  0  0  0  0  0  0  0  0  0  0
 0  0  0  0  0  0  0  0  1  1  1  1  1  1  0  2  3  3  2  1  1  2  2  1  0  1  1  0  0  0  0  0  1  0  0  0  0
 0  0  0  0  0  0  1  1  0  0  1  1  1  1  2  3  4  3  2  2  2  2  2  1  1  1  1  1  0  0  0  0  0  0  0  0  0
 0  0  0  0  0  1  0  0  1  0  0  1  2  4  5  6  7  6  4  4  5  4  3  1  0  0  1  1  0  1  0  0  0  0  0  0  0
 0  0  0  0  1  0  0  0  0  1  2  2  3  3  3  6 11 15 11  6  5  4  4  3  2  2  1  1  1  1  1  0  0  0  0  0  0
 0  0  0  0  1  0  0  0  1  2  2  2  3  2  2  4  8 13 11  7  4  2  4  3  2  3  2  0  1  0  0  1  0  0  0  0  0
 0  0  0  0  1  1  1  0  0  1  1  1  2  2  1  5 10 10 10 13 11  5  2  2  3  2  1  1  0  0  0  0  0  0  0  0  0
 1  1  0  0  1  1  1  1  1  1  1  2  1  1  5 11 19 21 23 28 22 10  5  2  2  3  2  1  1  0  0  0  0  0  0  0  1
 0  0  0  0  1  1  1  1  2  3  3  4  6 12 23 33 39 44 43 34 20  9  5  4  4  5  3  1  1  1  1  1  0  0  0  0  0
 0  0  1  1  1  1  1  2  5  6  6  7  9 23 46 50 52 58 45 43 45 23  6  6  6  6  6  3  1  1  1  1  1  1  1  1  1
 1  1  2  1  1  2  4  6  6  6  9 14 28 40 54 51 73100 71 43 52 47 24 13  6  5  5  5  4  2  1  1  2  2  1  1  1  1
 1  1  1  2  1  2  4  5  3  7 13 19 30 40 46 56 80 99 87 55 42 44 34 19 12  6  3  4  4  2  1  1  1  1  1  1  1  1
 1  1  1  1  2  2  2  3  6 11 16 14 23 43 58 67 64 39 56 69 60 47 22 14 21 14  7  4  2  2  2  2  1  1  1  1  1
 0  1  1  1  1  1  1  2  4  7 13 18 15 23 37 44 46 61 84 72 48 47 43 21 18 25 13  8  5  2  2  2  2  1  0  0  0
 2  3  1  1  1  1  1  2  4 14 21 22 25 19 39 32 35 84 55 31 35 21 23 27 25 11  4  3  1  1  0  2  1  0  0  0  0
 1  1  1  1  1  1  1  0  2  4 18 22 35 53 32 64 49  9 37 10 37 61 35 54 41 23 15  5  2  1  2  1  2  1  1  1  1
 1  1  1  1  1  1  1  0  2  3 18 23 45 77 32 33 30 21 59 21 29 35 34 79 46 21 18  4  2  1  1  1  1  0  1  1  1
 0  0  0  2  2  3  1  2  4 22 33 34 46 14 19 37 27 38 34 53 25 14 49 28 26 24  5  2  1  2  2  1  0  1  1  1  1
 0  0  0  2  2  3  1  3  6 19 30 13 12 15 30 67 87 84 73 71 36 16 18  8 21 18  4  2  1  2  2  1  0  1  1  1  1
 0  1  1  2  1  1  2  4  4  5 14  7 20 52 53 51 75 85 61 44 47 49 27  7  9  5  1  2  1  1  1  1  1  1  0  0  0
 1  1  2  2  2  2  2  4  2  3 15 23 36 73 93 75 49 40 49 67 80 69 39 22 16  5  1  2  2  1  1  1  1  1  1  1  1
 1  1  1  1  1  2  1  1  0  5 20 36 41 47 60 80 95 99 92 80 61 43 34 30 21  8  2  2  1  1  1  1  1  0  1  1  1
 1  1  1  1  1  1  1  2  5  7  7 12 21 32 39 40 49 80 99 82 60 48 37 26 19 13 10  9  7  2  1  1  1  1  1  1  1
 1  1  1  1  1  1  2  7 12 10  4  4 10 31 54 53 50 58 59 60 53 31 12  5  5 10 11  6  2  1  1  1  1  1  0  0  0
 0  0  1  1  1  1  1  3  7  8  3  1  3 11 28 38 41 45 41 34 25 12  4  1  2  5  5  2  1  1  1  1  0  0  0  0  0
 0  0  0  0  1  1  1  1  2  4  3  2  3  3  7 16 24 23 18 12  7  4  2  1  2  2  1  0  1  1  1  0  0  0  0  0  0
 1  1  1  0  1  2  1  0  0  1  3  4  2  1  4 11 13 10 10 10  4  1  1  3  2  1  0  0  1  2  1  0  0  0  0  0  0
 0  0  0  1  1  2  2  1  0  1  2  4  4  2  5 10 13 13 10  7  5  3  4  3  2  1  0  0  1  2  1  1  0  0  0  0  0
 0  0  0  1  1  1  1  1  0  2  3  3  3  2  4  6 11 14 10  5  4  3  3  3  2  1  0  0  1  1  1  0  0  0  0  0  0
 0  0  0  0  0  0  0  1  1  1  2  2  2  3  3  3  4  6  6  3  2  2  2  1  1  1  0  0  0  0  0  0  0  0  0  0  0
 0  0  0  0  1  0  0  0  0  1  1  0  1  2  3  2  2  2  3  3  2  2  1  0  0  0  1  1  1  0  0  1  1  0  0  0  0
 0  0  0  1  1  0  0  0  0  1  1  1  1  1  1  1  1  2  3  3  2  1  1  1  1  1  1  0  0  1  1  1  0  0  0  0  0
 0  0  1  0  0  0  0  0  0  0  1  1  1  1  1  3  3  2  1  2  4  4  2  1  1  1  2  1  1  0  0  1  0  0  0  0  0
 0  0  0  0  0  0  0  0  0  0  0  1  1  1  1  2  2  1  0  1  2  3  2  1  1  1  1  1  0  0  0  0  0  0  0  0  0
```

Figure A46

Point Spread Function
Cube #2

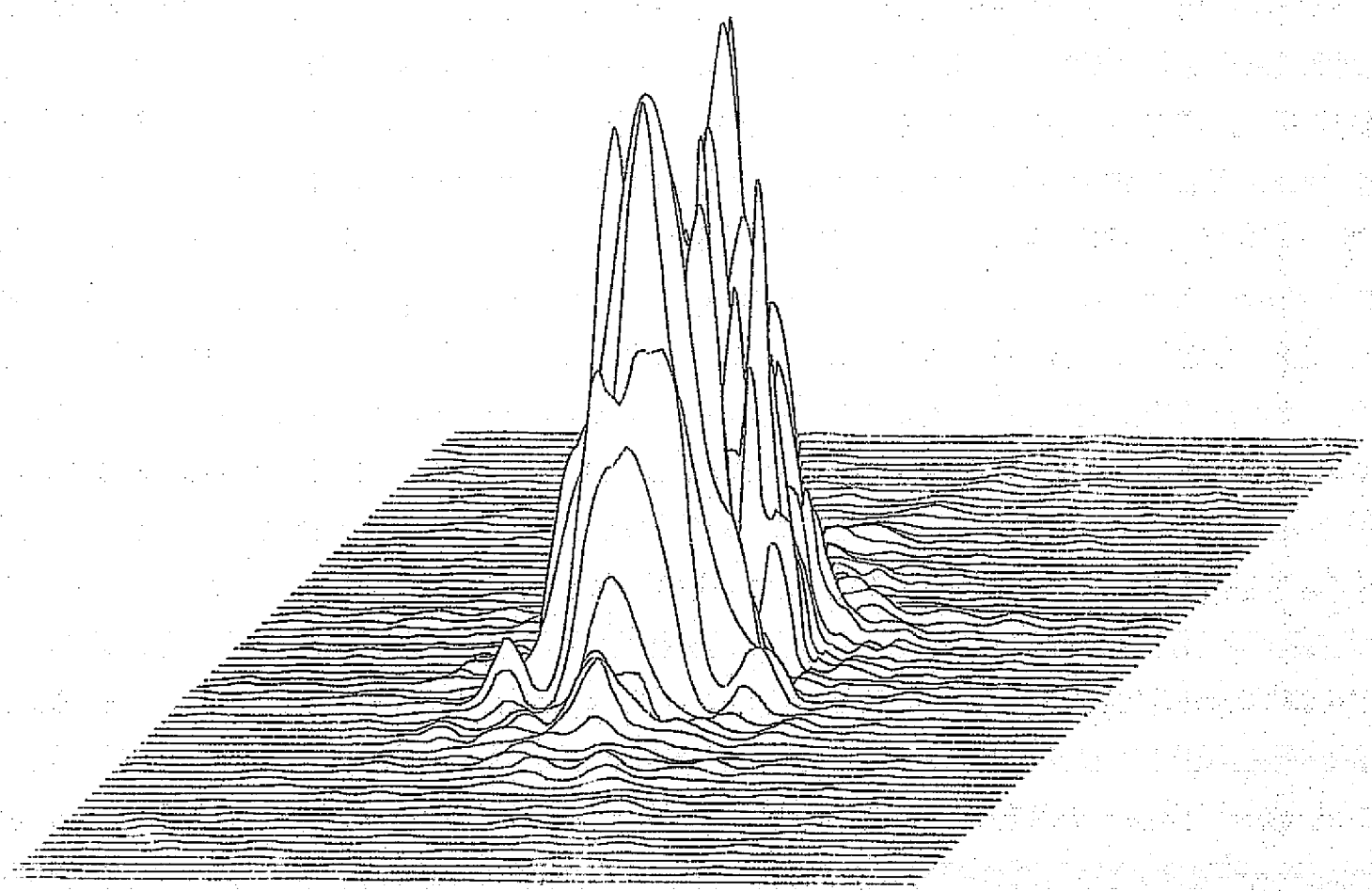


Figure A47

Intensity Distribution - Central 129 Microradians

Cube #2

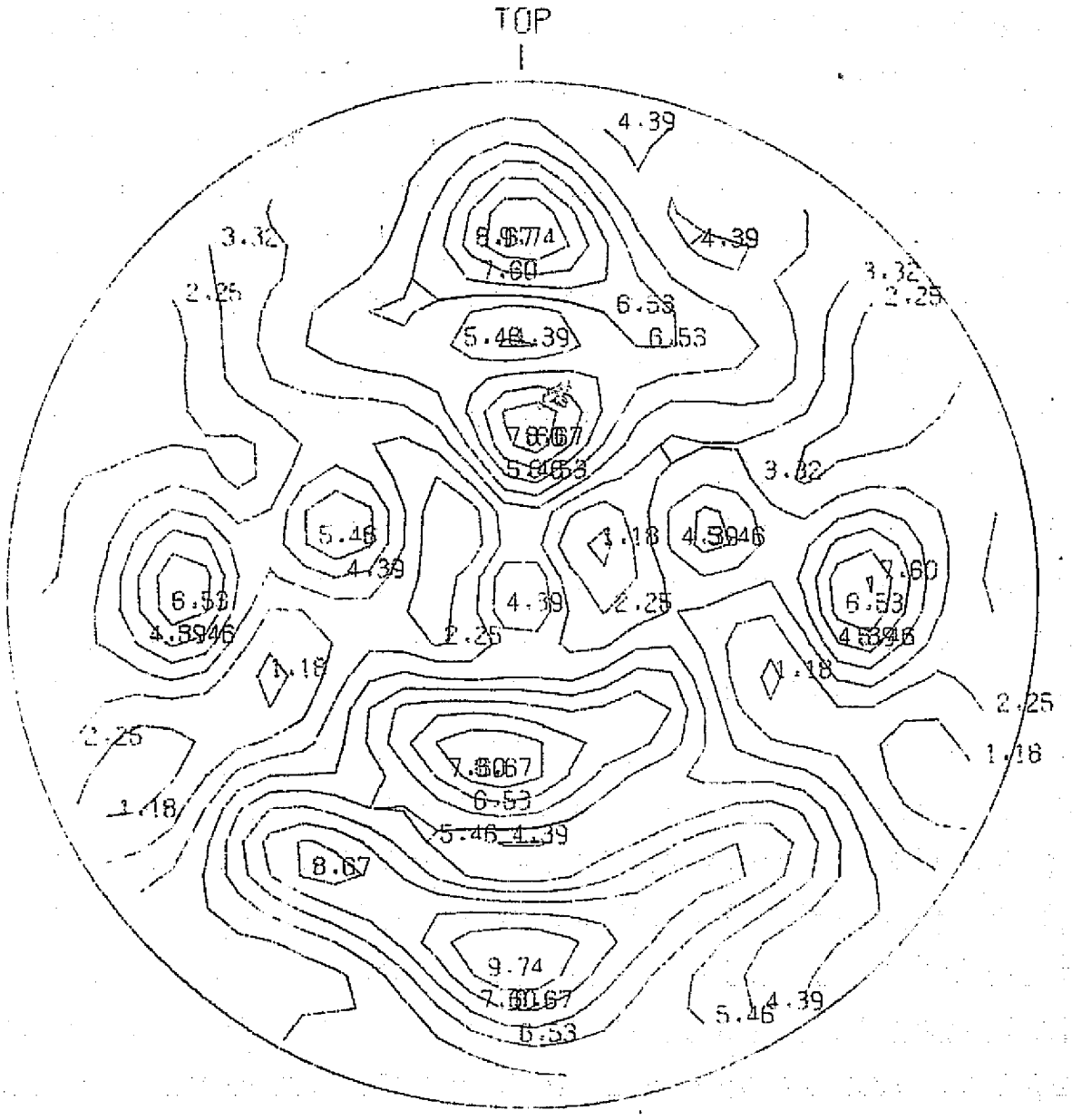


Figure A48

Encircled Energy
Vs
Field Angle

Cube #2

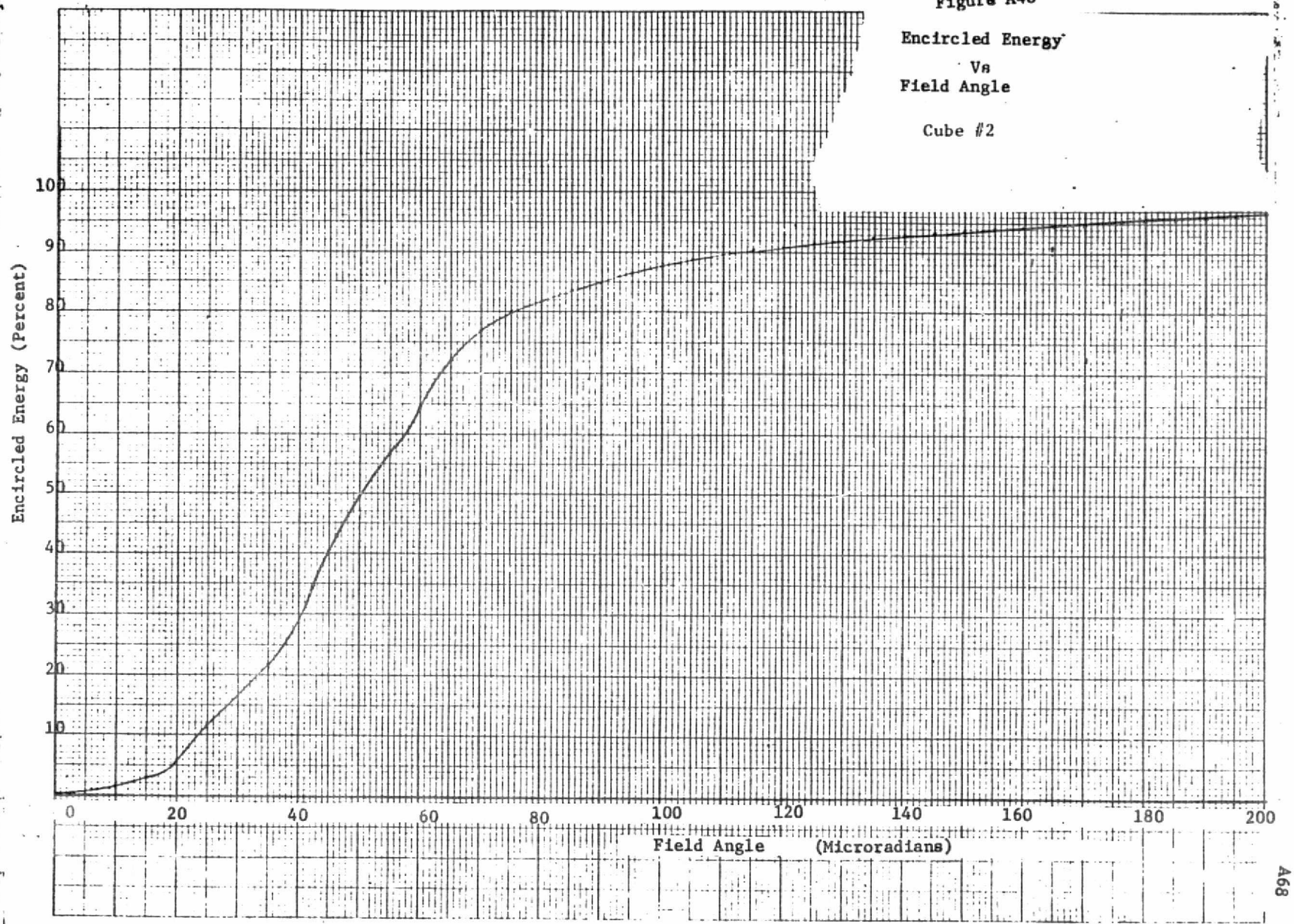


Table A20

ENCIRCLED ENERGY

Cube #2

CIRCLE RADIUS (MICRONS)	PERCENT ENERGY WITHIN CIRCLE CENTERED AT INDICATED COORDINATES								
	CENTER (MICRONS):								
	X= -10.13	10.13	0.0	-10.13	0.0	10.13	0.0	-10.13	10.13
	Y= -10.13	-10.13	-10.13	0.0	0.0	0.0	10.13	10.13	10.13
2.00	0.0	0.0	0.1	0.0	0.1	0.0	0.1	0.0	0.0
4.00	0.1	0.2	0.2	0.1	0.1	0.1	0.2	0.4	0.4
6.00	0.1	0.2	0.6	0.3	0.8	0.3	0.7	0.4	0.4
8.00	0.6	0.7	1.1	0.7	0.8	0.7	1.3	1.1	1.2
10.00	1.0	1.0	1.5	0.9	1.4	1.0	1.8	1.6	1.7
12.00	2.5	2.6	2.3	1.7	1.5	1.7	2.9	3.2	3.3
14.00	2.5	2.6	3.0	2.7	2.4	2.8	4.1	3.2	3.3
16.00	4.4	4.5	4.0	3.6	3.0	3.7	5.2	5.0	5.1
18.00	5.2	5.4	5.0	4.8	5.5	5.0	6.4	5.9	6.0
20.00	6.8	6.9	6.5	6.2	6.5	6.3	7.8	7.4	7.4
22.00	7.5	7.7	8.0	8.0	8.9	8.1	9.1	8.3	8.3
24.00	9.5	9.7	9.3	9.0	10.1	9.2	10.2	10.3	10.3
26.00	10.5	10.7	11.4	11.2	13.2	11.3	11.8	11.4	11.4
28.00	13.3	13.5	14.3	13.8	13.9	13.9	14.7	14.3	14.2
30.00	15.1	15.4	16.2	15.8	16.0	15.9	16.2	16.3	16.2
32.00	19.2	19.4	19.1	18.1	17.9	18.2	19.3	20.3	20.2
34.00	20.1	20.3	21.4	21.0	20.1	21.0	21.9	21.2	21.2
36.00	24.5	24.6	24.5	23.4	22.6	23.5	25.4	25.4	25.5
38.00	26.5	26.6	26.9	26.3	26.6	26.4	28.1	27.5	27.6
40.00	30.1	30.1	29.8	28.9	28.6	29.0	31.5	31.1	31.3
42.00	31.9	31.8	33.0	32.8	34.4	32.9	34.9	32.8	33.1
44.00	35.5	35.5	35.6	34.8	36.9	34.9	37.7	36.7	37.0
46.00	37.9	38.0	39.0	39.4	42.8	39.5	41.0	39.3	39.6
48.00	41.5	41.5	43.1	42.9	44.0	43.0	44.9	43.1	43.3
50.00	44.2	44.4	45.7	46.2	49.1	46.3	47.3	46.1	46.1
52.00	48.2	48.3	49.7	49.9	51.1	50.0	51.1	50.0	49.9
54.00	50.4	50.5	52.5	53.5	55.2	53.6	53.7	52.2	52.0
56.00	54.5	54.7	56.9	57.2	57.4	57.2	57.9	56.1	55.9
58.00	57.5	57.6	59.1	59.8	61.5	59.8	60.1	58.8	58.5
60.00	60.8	60.8	62.5	62.9	64.1	62.8	63.4	61.8	61.6
62.00	62.9	62.8	64.7	65.0	67.5	65.9	65.7	63.7	63.6
64.00	66.3	66.2	67.2	68.0	70.0	67.8	68.2	66.8	66.8
66.00	69.1	67.9	69.6	71.1	73.2	70.9	70.5	68.6	68.7
68.00	70.9	70.6	71.9	72.7	74.5	72.6	72.5	71.1	71.4
70.00	72.3	72.0	73.8	75.0	76.9	74.9	74.2	72.5	72.7
72.00	74.7	74.5	75.7	75.4	78.2	76.4	76.0	74.8	75.0
74.00	75.9	75.7	77.4	78.2	79.6	78.2	77.4	75.9	76.0
76.00	77.9	77.8	79.2	79.4	80.3	79.5	78.9	77.9	78.0
78.00	79.3	79.1	80.0	80.4	81.3	80.5	79.7	79.0	79.0
80.00	80.4	80.5	81.3	81.3	81.8	81.4	81.0	80.5	80.4

Table A21

ENCIRCLED ENERGY

Cube #2

CIRCLE RADIUS (MICRONS)	PERCENT ENERGY WITHIN CIRCLE CENTERED AT INDICATED COORDINATES								
	CENTER (MICRONS):								
	X= -10.13	10.13	0.0	-10.13	0.0	10.13	0.0	-10.13	10.13
	Y= -10.13	-10.13	-10.13	0.0	0.0	0.0	10.13	10.13	10.13
5.00	0.1	0.2	0.5	0.2	0.5	0.2	0.5	0.4	0.4
10.00	1.0	1.0	1.5	0.9	1.4	1.0	1.8	1.6	1.7
15.00	3.6	3.8	3.8	3.2	3.0	3.3	4.9	4.3	4.3
20.00	6.8	6.9	6.5	5.2	5.5	6.3	7.8	7.4	7.4
25.00	10.2	10.4	10.9	10.9	11.6	11.0	11.4	11.1	11.0
30.00	15.1	15.4	16.2	15.8	16.6	15.9	16.2	16.3	16.2
35.00	22.7	22.9	23.0	21.8	21.9	21.9	23.5	23.7	23.6
40.00	30.1	30.1	29.8	28.9	28.6	29.0	31.5	31.1	31.3
45.00	36.8	36.8	37.5	37.9	40.7	38.0	39.5	38.1	38.5
50.00	44.2	44.4	45.7	45.2	49.1	46.3	47.3	46.1	46.1
55.00	53.1	53.2	55.2	55.5	56.9	55.5	56.3	54.7	54.5
60.00	60.8	60.8	62.5	62.9	64.1	62.8	63.4	61.8	61.6
65.00	67.2	67.0	68.7	69.8	72.0	69.7	69.6	67.6	67.8
70.00	72.3	72.0	73.8	75.0	76.9	74.9	74.2	72.5	72.7
75.00	76.9	76.9	78.4	79.8	80.9	78.9	78.3	77.1	77.1
80.00	80.4	80.5	81.3	81.3	81.8	81.4	81.0	80.5	80.4
85.00	82.7	82.8	83.2	83.3	83.4	83.3	83.3	82.8	82.7
90.00	84.4	84.5	84.6	84.8	84.9	84.8	84.9	84.6	84.5
95.00	85.9	85.9	86.0	86.1	86.4	86.1	86.3	86.1	86.1
100.00	87.2	87.1	87.3	87.4	87.7	87.4	87.4	87.2	87.2
105.00	88.2	88.2	88.5	88.6	88.8	88.6	88.4	88.2	88.2
110.00	89.2	89.2	89.4	89.5	89.7	89.5	89.2	89.1	89.1
115.00	90.1	90.0	90.1	90.2	90.3	90.2	90.0	90.0	90.0
120.00	90.7	90.7	90.7	90.8	90.8	90.8	90.8	90.7	90.7
125.00	91.3	91.2	91.3	91.3	91.4	91.3	91.4	91.3	91.3
130.00	91.8	91.8	91.9	91.9	91.9	91.9	91.9	91.8	91.9
135.00	92.2	92.3	92.3	92.3	92.5	92.3	92.4	92.4	92.3
140.00	92.7	92.7	92.8	92.9	92.9	92.9	92.9	92.8	92.8
145.00	93.1	93.1	93.2	93.3	93.2	93.3	93.3	93.2	93.2
150.00	93.5	93.5	93.5	93.6	93.7	93.7	93.6	93.6	93.6
155.00	93.9	93.9	93.9	94.0	94.0	94.0	93.9	93.9	93.9
160.00	94.2	94.3	94.2	94.2	94.2	94.3	94.3	94.3	94.3
165.00	94.5	94.5	94.6	94.5	94.5	94.6	94.6	94.6	94.6
170.00	94.8	94.8	94.9	94.9	94.9	94.9	94.9	94.8	94.8
175.00	95.1	95.1	95.1	95.1	95.1	95.1	95.2	95.1	95.1
180.00	95.4	95.4	95.4	95.4	95.5	95.4	95.5	95.4	95.4
184.99	95.7	95.7	95.6	95.7	95.7	95.7	95.7	95.7	95.7
189.99	95.9	95.9	95.9	96.0	96.0	96.0	96.0	96.0	96.0
194.99	96.1	96.1	96.1	96.2	96.2	96.2	96.2	96.2	96.2
199.99	96.4	96.4	96.4	96.4	96.4	96.4	96.4	96.5	96.5

Figure A49

Wavefront Map - Q Polarization

Cube #3

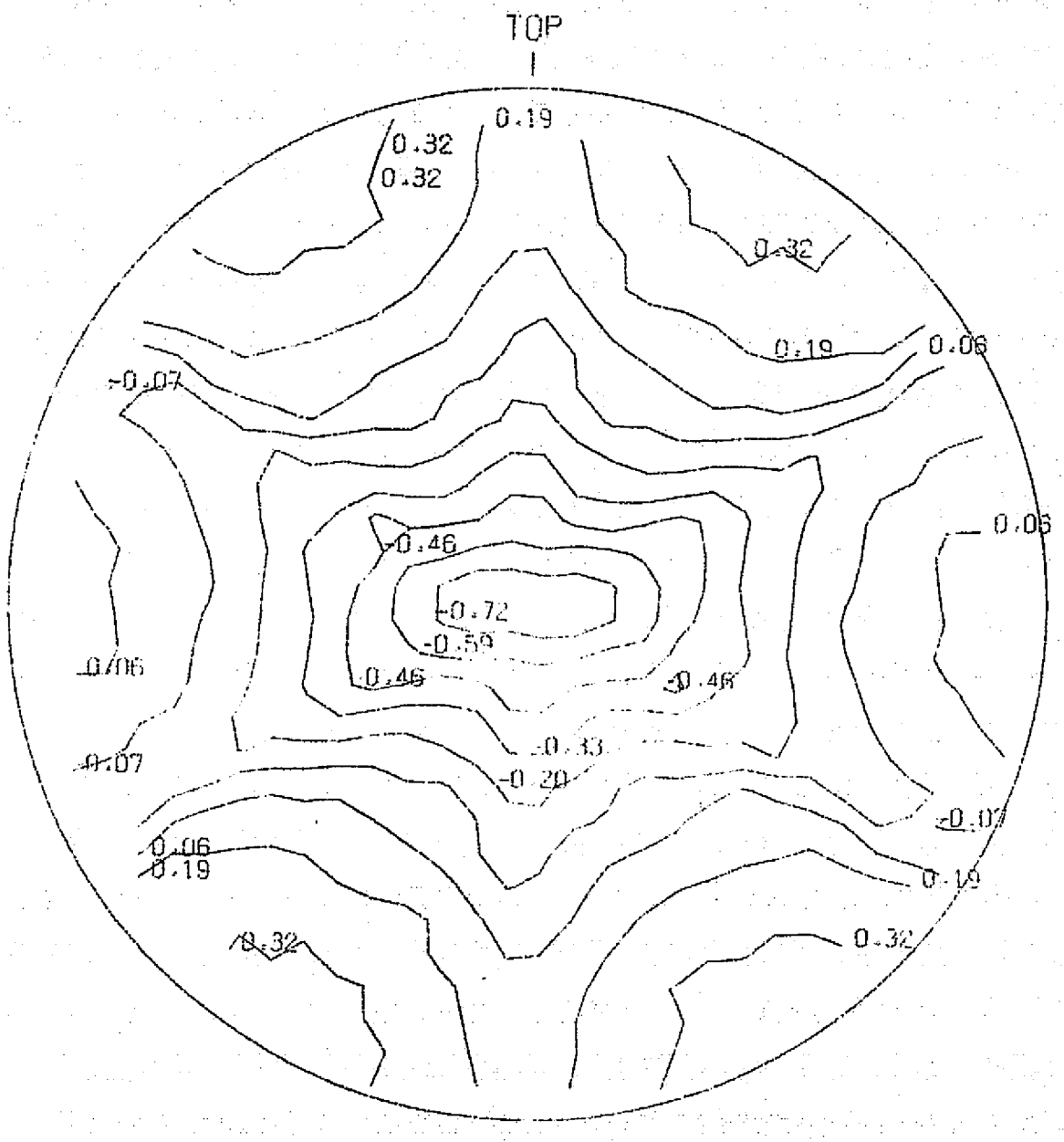
MAP IN UNITS OF 0.01 WAVES

```
                                33 30 24 19 13 13 19 25 28 32
                          41 40 34 32 28 24 17 12 13 18 24 29 34 35 36 33
                       37 39 39 35 30 28 26 17 10  9 16 24 27 31 35 35 33 33
                    34 34 37 38 35 32 28 23 15  8  9 16 21 25 31 33 33 33 32 33
                 31 33 34 33 31 31 24 23 18 10  5  5 12 16 23 27 29 32 31 33 28 29
              27 28 29 31 31 29 24 23 20 12  6 -1  0  8 17 21 23 25 30 30 30 28 26 24
           15 22 25 26 26 28 24 21 18 13  9 -2 -5 -7  1 10 15 16 19 24 24 25 23 23 22  9
        -4 -1  3  8 16 21 18 16 13  9  6  4 -2 -9 -11 -6  2  8 11 14 18 19 19 18 18  2 -4 -5
        -7 -7 -5 -7  6 11 13 11 10  4  0 -5 -8 -18 -15 -6 -3  0  6  9 11 13 12  9  2 -11 -18 -15
        -3 -5 -8 -8 -11 -1 -3 -6 -2 -4 -3 -8 -17 -21 -23 -12 -5 -5  0  3 -0  2  0 -8 -13 -13 -14 -9
     6  3  2 -2 -8 -14 -15 -20 -15 -16 -12 -14 -19 -28 -33 -32 -23 -17 -14 -12 -14 -15 -17 -20 -14 -17 -9 -2  0  2
     8  6  3  2 -5 -13 -16 -23 -26 -27 -28 -27 -27 -35 -44 -43 -29 -28 -23 -27 -32 -30 -23 -21 -15 -7 -5  1  3  2
     8  7  5  3 -2 -10 -17 -21 -28 -34 -48 -42 -43 -45 -49 -51 -41 -38 -44 -49 -43 -34 -26 -17 -11 -3  2  5  5  5
     8  8  7  3 -2 -7 -15 -21 -34 -39 -42 -54 -56 -62 -64 -60 -64 -62 -57 -57 -43 -32 -23 -16 -10 -3  3  7  8  8
  11  7  6  1 -3 -5 -15 -22 -32 -42 -49 -64 -73 -81 -81 -77 -77 -73 -64 -52 -43 -30 -24 -14 -8 -2  1  7 10  9
     9 10  7  1 -2 -8 -14 -24 -30 -43 -52 -64 -73 -77 -77 -81 -81 -73 -64 -49 -42 -32 -22 -15 -5 -3  1  6  7 11
     8  9  7  3 -3 -10 -16 -23 -32 -43 -57 -57 -62 -64 -60 -64 -62 -56 -54 -42 -39 -34 -21 -15 -7 -2  3  7  9  8
     5  5  5  2 -3 -11 -17 -26 -34 -43 -49 -44 -38 -41 -51 -49 -45 -43 -42 -48 -34 -28 -21 -17 -10 -2  3  5  7  8
     2  3  1 -5 -7 -15 -21 -23 -30 -32 -27 -23 -28 -29 -43 -44 -35 -27 -27 -28 -27 -26 -23 -16 -13 -5  2  3  6  8
     2  0 -2 -9 -17 -14 -20 -17 -15 -14 -12 -14 -17 -23 -32 -33 -28 -19 -14 -12 -16 -15 -20 -15 -14 -9 -2  2  3  6
        -8 -14 -13 -13 -8  0  2  0  3  0 -5 -5 -12 -23 -21 -17 -8 -3 -4  2  6  3 -1 -11 -8 -9 -5 -3
     -15 -19 -11 -2 -9 -12 -13 -11 -9  6 -0 -3 -6 -15 -18 -8 -5 -0  4 -10 -11 -13 -11 -6 -7 -5 -7 -7
        -5 -4  2 10 10 10 10 10 14 11  8  2 -6 -11 -9 -2  4  6  9 13 16 18 21 16  8  3 -1 -4
           9 22 23 23 25 24 24 19 16 15 10  1 -7 -5  2  9 13 18 21 24 28 26 26 25 22 15
              24 26 29 30 31 30 25 23 21 17  8  0 -1  6 12 20 23 24 29 31 31 29 28 27
                 29 28 33 31 32 29 27 23 16 12  5  5 10 18 23 24 31 31 33 34 33 31
                    33 32 33 33 32 31 25 21 16  9  8 15 23 28 32 35 38 37 34 34
                       33 33 35 35 31 27 24 16  9 10 17 26 28 30 35 39 39 37
                          33 36 35 34 29 24 18 13 12 17 24 28 32 34 40 41
                                32 29 25 18 13 13 19 24 30 33
```

Figure A50

Wavefront Plot – Q Polarization

Cube #3



A73

Figure A51

Wavefront Map – P Polarization

Cube #3

MAP IN UNITS OF 0.01 WAVES

										91	88	83	77	71	22	28	33	36	40										
							100	98	92	90	86	83	76	70	21	26	32	37	42	43	45	42							
						96	98	98	94	88	87	84	76	69	18	25	32	35	39	44	44	42	41						
					92	93	95	97	94	91	86	82	73	67	17	24	30	34	40	41	41	42	41	41					
				89	91	92	92	90	89	83	81	77	69	64	13	20	25	32	36	37	41	39	41	37	37				
			85	87	88	89	89	87	83	82	78	71	64	57	8	16	26	29	31	34	38	38	38	36	35	33			
		73	80	83	84	85	86	83	80	76	72	67	60	53	1	9	19	24	25	27	32	32	34	31	32	30	18		
	11	56	62	67	75	79	77	75	71	67	65	62	56	49	-2	2	11	17	20	23	26	28	27	26	26	10	3	-39	
	8	8	10	51	65	69	71	69	68	63	59	52	50	39	-6	1	5	7	14	18	19	22	20	18	11	-45	-52	-49	
	12	10	6	7	46	57	61	65	60	54	55	49	41	36	-15	-3	3	2	9	11	9	11	8	0	-47	-47	-48	-43	
22	19	19	13	6	1	0	38	43	41	45	44	39	30	25	-23	-15	-9	-6	-3	-5	-6	-8	-54	-48	-51	-43	-36	-34	-31
24	27	19	18	10	2	0	-7	-10	30	29	30	30	22	13	-34	-21	-19	-15	-19	-23	-64	-57	-55	-49	-41	-39	-32	-30	-31
24	23	21	19	13	5	1	-5	-12	-18	-32	16	14	12	9	-43	-33	-29	-36	-83	-77	-68	-60	-51	-45	-37	-31	-28	-26	-20
24	25	23	19	13	9	0	-5	-18	-23	-26	-38	2	-3	-5	-51	-55	-53	-91	-91	-77	-66	-57	-50	-44	-37	-30	-26	-25	-25
27	23	22	17	12	10	0	-6	-16	-26	-33	-48	-57	-65	-22	-69	-111	-107	-98	-86	-77	-64	-58	-48	-42	-36	-32	-26	-23	-24
25	26	23	17	13	7	1	-8	-14	-27	-36	-48	-57	-61	-57	-10	-115	-107	-98	-83	-76	-66	-56	-49	-39	-37	-32	-27	-26	-22
24	24	23	19	12	5	0	-7	-16	-27	-41	-41	-42	-44	-40	5	8	14	-88	-76	-73	-68	-55	-49	-41	-36	-30	-26	-24	-25
21	21	21	18	12	4	-1	-10	-18	-27	-33	-24	-18	-21	-31	20	24	26	27	-82	-68	-62	-55	-51	-44	-36	-30	-28	-26	-25
19	19	17	10	8	0	-5	-7	-14	-12	-7	-3	-8	-9	-23	25	34	42	42	41	42	-60	-57	-50	-47	-39	-31	-30	-27	-25
18	15	13	6	-1	1	-4	2	5	5	7	5	2	-3	-12	37	42	50	56	57	53	55	50	-49	-48	-43	-36	-31	-30	-27
	6	1	2	2	12	20	22	21	23	20	14	14	7	-3	48	53	61	67	66	72	77	73	68	58	-42	-43	-39	-37	
	0	2	4	22	29	32	33	31	29	26	19	16	13	4	51	61	64	70	74	80	81	83	81	76	62	39	41	41	
	10	15	22	38	39	39	40	38	34	31	29	22	13	9	61	68	74	77	79	83	86	88	91	87	79	74	68	-38	
		29	42	43	43	45	44	44	39	37	36	30	21	12	65	72	79	83	88	91	95	98	96	96	95	92	85		
			44	46	48	50	50	50	46	43	41	37	28	20	69	76	83	90	93	95	99	101	101	99	98	97			
				49	49	53	51	52	49	47	43	36	32	25	76	81	88	93	95	101	101	103	104	103	101				
					53	52	53	53	53	51	46	41	36	29	79	85	93	98	102	105	108	107	104	104					
						53	53	55	55	51	47	44	36	29	81	88	96	99	100	106	109	109	107						
							53	56	55	54	49	44	38	33	82	88	94	98	102	104	110	112							
										52	49	45	40	34	83	89	94	100	103										

ORIGINAL PAGE IS OF POOR QUALITY

Figure A52

Wavefront Plot - P Polarization

Cube #3

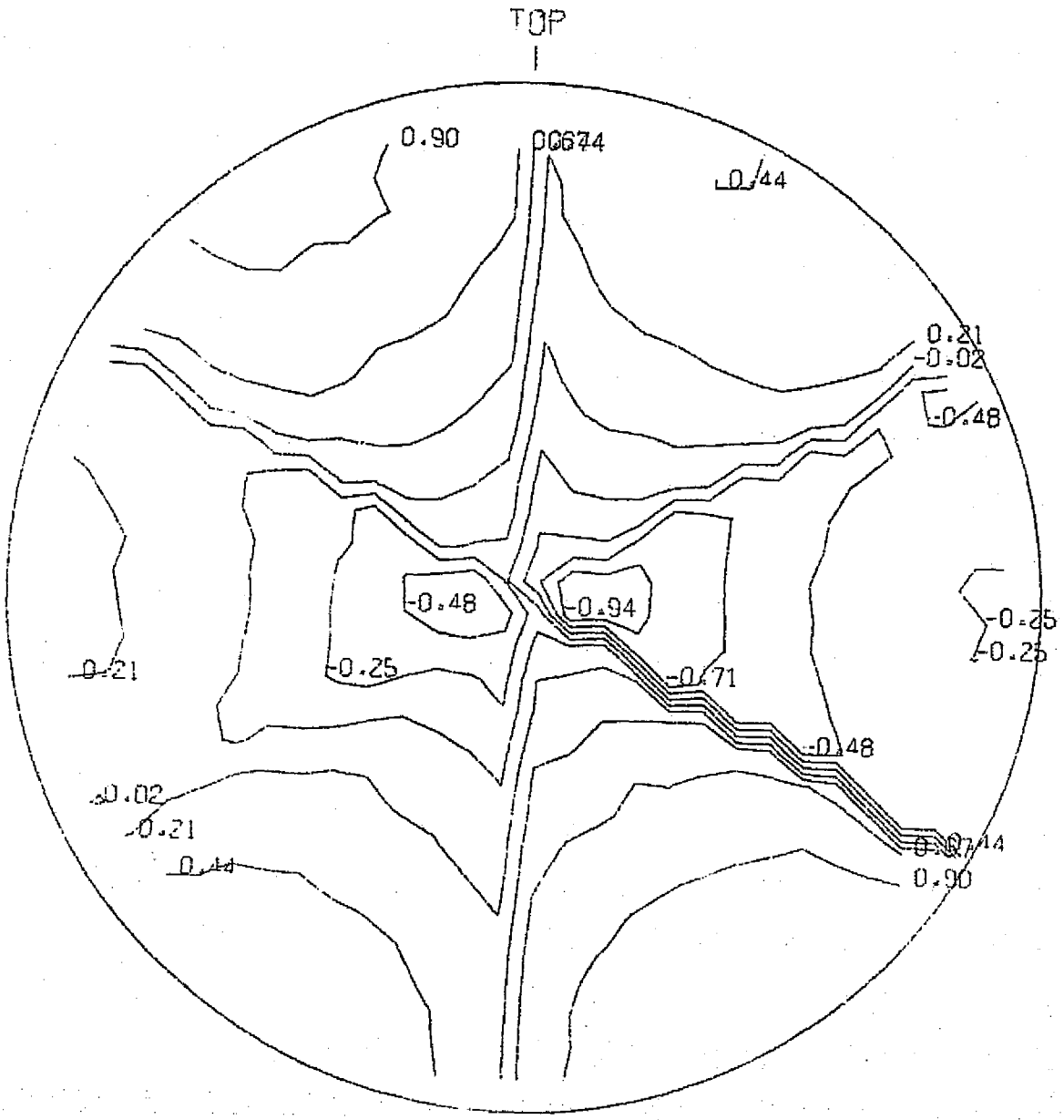


Figure A53

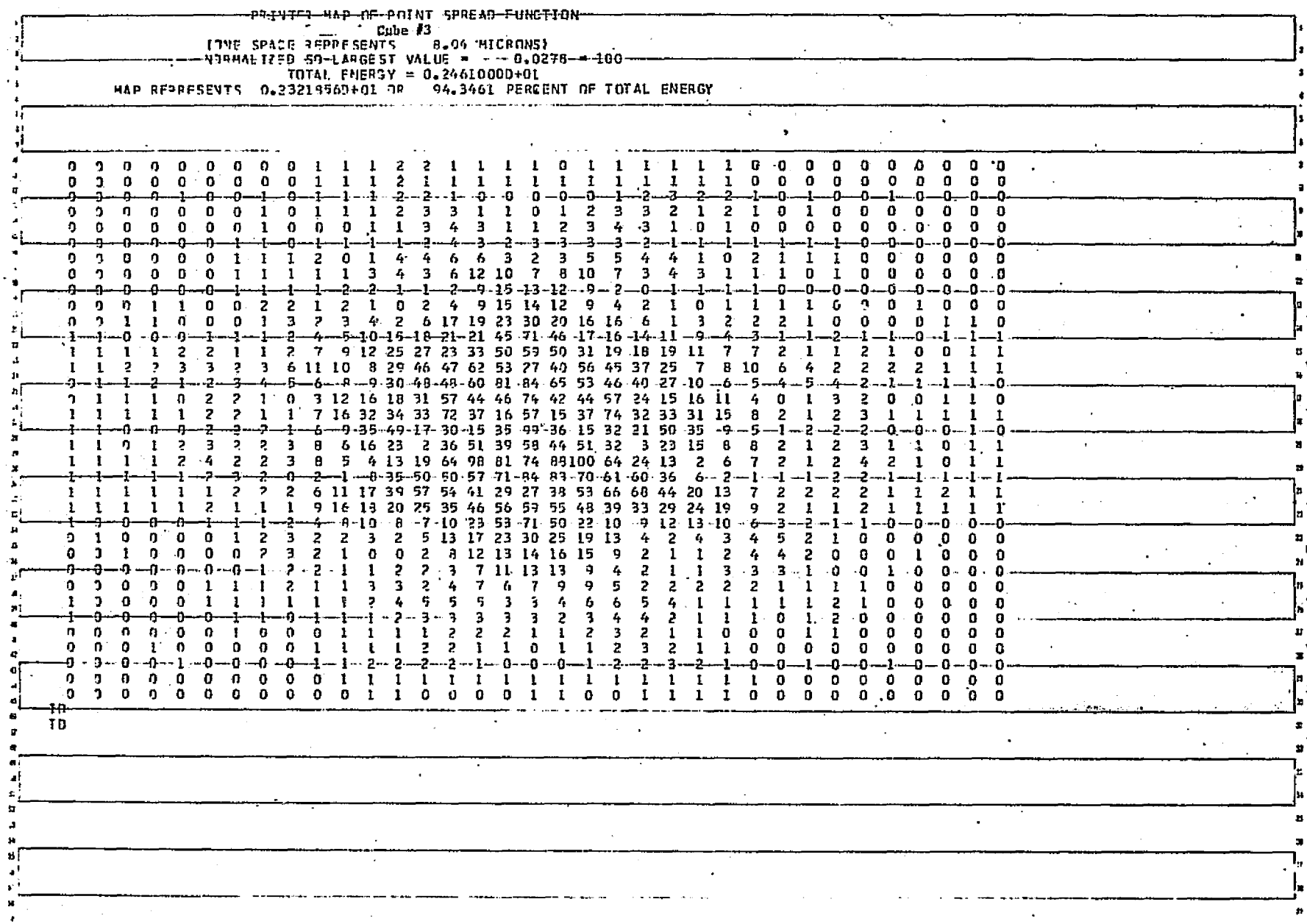


Figure A54

Point Spread Function

Cube #3

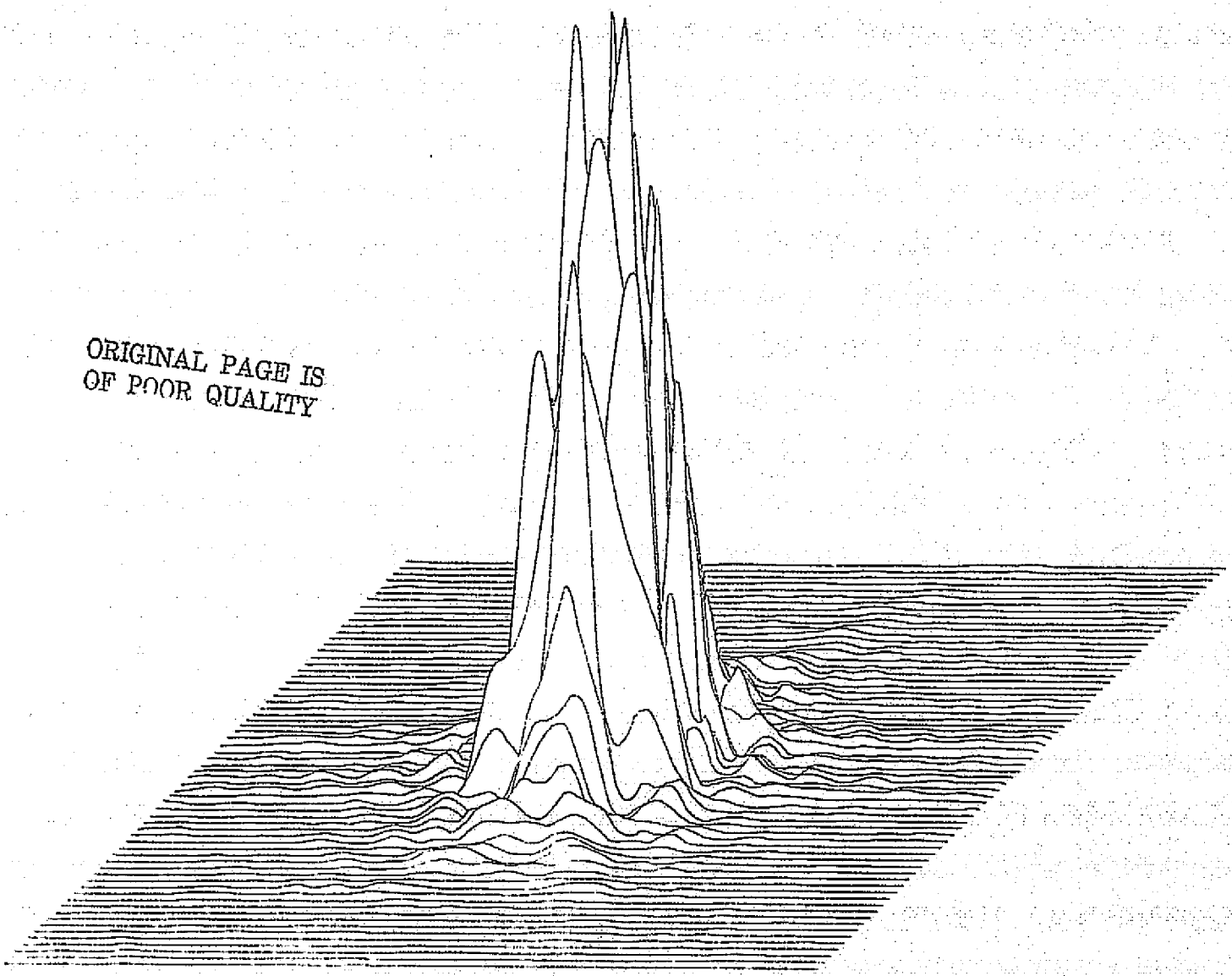


Figure A55

Intensity Distribution - Central 129 Microradians
Cube #3

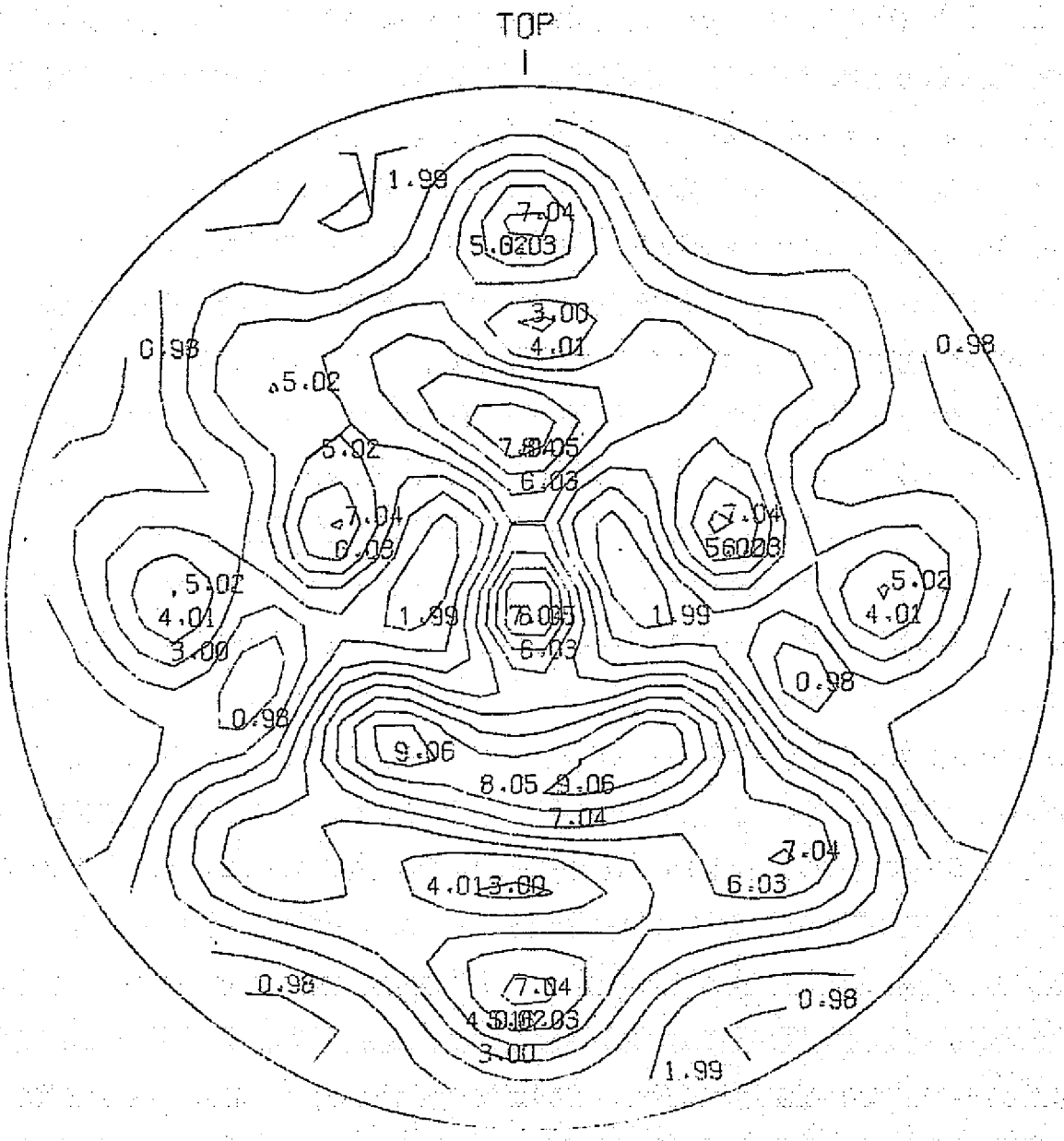


Figure A56

Encircled Energy
Vs
Field Angle

Cube #3

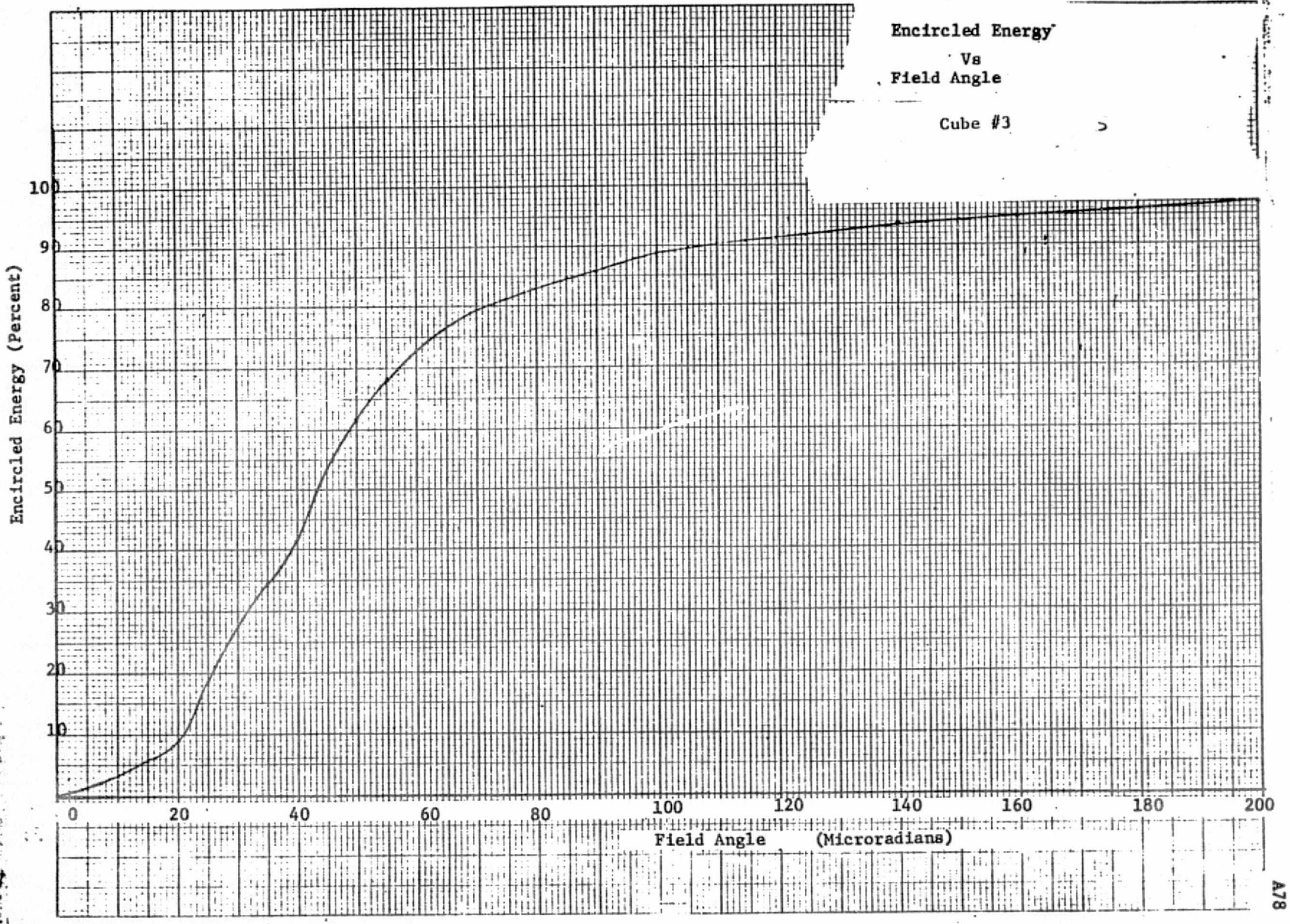


Table A22

ENCIRCLED ENERGY

Cube #3

CIRCLE RADIUS (MICRONS)	PERCENT ENERGY WITHIN CIRCLE CENTERED AT INDICATED COORDINATES								
CENTER (MICRONS): X=	-10.13	10.13	0.0	-10.13	0.0	10.13	0.0	-10.13	10.13
Y=	-10.13	-10.13	-10.13	0.0	0.0	0.0	-10.13	-10.13	-10.13
2.00	0.0	0.0	0.2	0.0	0.3	0.0	0.2	0.0	0.0
4.00	0.2	0.2	0.3	0.1	0.3	0.1	0.3	0.6	0.7
6.00	0.2	0.2	1.9	0.5	1.9	0.5	1.1	0.6	0.7
8.00	1.0	1.0	1.9	1.2	1.9	1.2	2.2	1.9	2.0
10.00	1.6	1.5	2.4	1.5	3.2	1.6	3.0	2.7	2.8
12.00	4.1	4.0	3.9	3.0	3.6	3.8	4.9	5.5	5.7
14.00	4.1	4.0	5.0	4.8	4.8	4.9	7.0	5.5	5.7
16.00	7.4	7.2	6.7	6.4	5.6	6.4	8.8	8.6	8.9
18.00	8.7	8.6	8.1	8.4	8.9	8.5	10.8	10.1	10.4
20.00	11.3	11.0	10.5	10.7	8.9	10.8	13.1	12.3	12.8
22.00	12.5	12.3	12.8	13.7	13.9	13.7	15.3	13.7	14.1
24.00	15.5	15.2	14.6	15.1	16.3	15.1	16.8	16.4	17.0
26.00	16.9	16.6	17.9	18.5	21.3	19.5	19.3	17.9	18.6
28.00	20.4	20.1	21.8	22.0	22.7	22.1	22.9	21.2	22.0
30.00	23.0	22.7	24.8	24.9	27.2	25.0	25.0	23.9	24.7
32.00	28.1	27.8	28.4	27.8	29.5	29.0	28.6	28.8	29.4
34.00	29.2	28.9	31.8	31.5	32.1	31.8	31.8	29.9	30.6
36.00	34.7	34.5	35.7	34.8	35.4	35.1	36.1	35.2	35.7
38.00	37.2	37.0	38.5	38.1	39.5	38.4	39.0	37.7	38.2
40.00	41.3	41.2	42.0	41.5	41.5	41.7	43.1	42.0	42.2
42.00	43.4	43.3	45.3	45.7	46.9	45.8	46.8	44.2	44.4
44.00	47.3	47.3	47.7	47.6	49.7	47.7	49.7	48.1	48.2
46.00	49.9	49.8	51.1	52.1	55.5	52.1	53.1	50.9	51.0
48.00	52.9	52.9	54.6	55.3	56.6	55.2	56.6	54.2	54.2
50.00	55.4	55.5	57.0	58.2	61.7	59.1	58.6	56.9	56.9
52.00	58.6	58.6	60.3	61.2	63.6	61.1	61.8	59.9	59.9
54.00	60.4	60.5	63.1	64.1	66.7	64.0	63.8	61.8	61.8
56.00	63.8	63.9	66.6	67.0	68.3	67.0	67.0	64.9	64.8
58.00	66.2	66.3	68.1	68.8	70.8	68.8	68.4	67.0	67.0
60.00	68.7	68.8	70.8	71.2	73.3	71.2	71.0	69.3	69.3
62.00	70.4	70.5	72.2	72.9	74.0	73.0	72.4	70.9	70.8
64.00	72.9	73.1	73.8	74.2	75.3	74.3	74.3	73.3	73.1
66.00	74.3	74.5	75.2	75.9	77.0	76.0	75.8	74.6	74.6
68.00	75.9	76.2	76.7	76.9	77.7	77.1	77.2	76.4	76.3
70.00	76.9	77.1	77.8	78.2	79.1	78.3	78.3	77.3	77.3
72.00	78.4	78.6	79.0	79.0	80.3	79.1	79.4	78.8	78.7
74.00	79.1	79.2	80.0	80.2	81.0	80.3	80.3	79.5	79.4
76.00	80.3	80.5	81.1	81.0	81.6	81.1	81.2	80.6	80.6
78.00	81.2	81.3	81.7	81.8	82.4	81.9	81.7	81.4	81.4
80.00	82.1	82.2	82.7	82.6	82.9	82.6	82.6	82.3	82.3

ENCIRCLED ENERGY

Cube #3

CIRCLE RADIUS	PERCENT ENERGY WITHIN CIRCLE CENTERED AT INDICATED COORDINATES								
(MICRONS)	CENTER (MICRONS): X=	-10.13	10.13	0.0	-10.13	0.0	10.13	0.0	-10.13	10.13
	Y=	-10.13	-10.13	-10.13	0.0	0.0	0.0	-10.13	-10.13	-10.13
5.00		0.2	0.2	0.8	0.4	1.2	0.4	0.9	0.6	0.7
10.00		1.6	1.5	2.4	1.5	3.2	1.6	3.0	2.7	2.8
15.00		6.1	5.9	6.3	5.6	5.6	5.7	8.2	7.3	7.6
20.00		11.3	11.0	10.5	10.7	8.9	10.8	13.1	12.3	12.8
25.00		16.4	16.1	17.1	19.1	18.3	18.1	18.9	17.4	18.0
30.00		23.0	22.7	24.8	24.9	27.2	25.0	25.0	23.9	24.7
35.00		32.6	32.4	33.7	32.7	34.6	32.9	33.6	33.0	33.5
40.00		41.3	41.2	42.0	41.5	41.5	41.7	43.1	42.0	42.2
45.00		48.6	48.6	48.7	50.6	53.2	50.6	51.6	49.7	49.8
50.00		55.4	55.5	57.0	58.2	61.7	58.1	58.6	56.9	56.9
55.00		62.6	62.7	65.0	65.7	68.1	65.6	65.7	63.7	63.7
60.00		68.7	68.8	70.8	71.2	72.3	71.2	71.0	69.3	69.3
65.00		73.5	73.7	74.8	75.3	76.3	75.4	75.2	73.9	73.8
70.00		76.9	77.1	77.8	78.2	79.1	78.3	78.3	77.3	77.3
75.00		79.3	80.0	80.5	80.6	81.4	80.6	80.9	80.2	80.2
80.00		82.1	82.2	82.7	82.6	82.9	82.6	82.6	82.3	82.3
85.00		83.9	83.9	84.4	84.3	84.4	84.4	84.2	83.9	83.9
90.00		85.4	85.4	85.6	85.7	85.8	85.8	85.6	85.4	85.4
95.00		86.7	86.8	86.8	87.0	87.1	87.0	86.9	86.8	86.8
100.00		87.8	87.8	87.9	88.1	88.4	88.1	88.1	87.9	87.9
105.00		88.8	88.8	89.0	89.1	89.3	89.1	89.1	88.9	88.8
110.00		89.7	89.8	89.9	89.9	90.1	89.9	89.9	89.7	89.7
115.00		90.6	90.6	90.6	90.6	90.7	90.6	90.5	90.5	90.5
120.00		91.2	91.2	91.3	91.2	91.2	91.2	91.2	91.2	91.2
125.00		91.8	91.8	91.8	91.8	91.8	91.8	91.8	91.8	91.7
130.00		92.3	92.3	92.3	92.4	92.5	92.4	92.4	92.3	92.3
135.00		92.8	92.8	92.8	92.9	93.0	92.9	92.8	92.8	92.8
140.00		93.2	93.2	93.3	93.4	93.4	93.4	93.4	93.3	93.3
145.00		93.6	93.6	93.6	93.8	93.8	93.8	93.8	93.7	93.7
150.00		94.0	94.0	94.0	94.1	94.1	94.1	94.2	94.1	94.1
155.00		94.3	94.3	94.4	94.4	94.4	94.4	94.5	94.4	94.4
160.00		94.7	94.7	94.7	94.7	94.7	94.7	94.7	94.7	94.8
165.00		95.0	95.0	95.0	95.0	95.0	95.0	95.0	95.1	95.0
170.00		95.3	95.2	95.3	95.3	95.3	95.3	95.4	95.3	95.3
175.00		95.5	95.5	95.5	95.6	95.6	95.6	95.6	95.6	95.6
180.00		95.8	95.8	95.8	95.9	96.0	95.9	95.9	95.9	95.9
184.99		96.1	96.1	96.0	96.1	96.1	96.1	96.1	96.1	96.1
189.99		96.3	96.3	96.3	96.4	96.4	96.4	96.4	96.4	96.4
194.99		96.5	96.5	96.5	96.6	96.6	96.5	96.6	96.6	96.6
199.99		96.7	96.7	96.7	96.8	96.8	96.7	96.8	96.8	96.8

Figure A57

Wavefront Map - Q Polarization

Cube #4

MAP IN UNITS OF 0.01 WAVES

								-46	-43	-39	-31	-19	18	26	33	41	45			
						49	48	47	42	39	34	24	12	13	25	34	39	42	46	48	48	
					50	48	46	41	36	34	27	16	11	9	23	27	34	39	41	45	44	45
				46	47	45	41	36	34	28	22	14	9	6	17	22	32	37	39	40	43	45	46
			43	40	40	40	35	32	27	24	17	11	3	3	13	20	26	28	32	32	37	41	42	42
		38	38	35	33	30	26	24	21	13	8	0	-4	-4	4	11	16	21	27	30	32	37	37	39	36
	28	35	33	29	27	25	20	20	13	9	4	-6	-14	-16	-1	8	12	17	22	26	26	29	32	30	32	19
15	9	22	24	25	23	17	15	13	7	4	0	-14	-22	-21	-10	2	5	9	14	16	19	19	24	26	17	5	5
6	2	1	7	7	7	6	5	2	-3	-7	-9	-16	-26	-24	-17	-8	1	2	8	12	13	15	7	6	3	0	3
5	4	-2	0	-7	-9	-1	-1	-6	-8	-12	-18	-24	-33	-33	-23	-16	-6	-4	0	3	2	3	-7	-11	-6	1	7
16	13	7	-4	-9	-17	-22	-22	-23	-15	-17	-17	-25	-29	-35	-35	-29	-24	-18	-9	-16	-21	-25	-18	-15	-9	-3	5	12	16
16	13	3	0	-8	-15	-25	-33	-29	-26	-35	-26	-32	-37	-44	-44	-37	-33	-31	-34	-33	-43	-33	-22	-17	-9	0	7	11	12
16	13	6	2	-9	-16	-22	-27	-38	-47	-51	-45	-44	-44	-55	-52	-42	-39	-40	-51	-47	-40	-28	-21	-16	-8	-3	-8	-14	-18
17	12	9	5	-9	-17	-19	-26	-41	-48	-56	-57	-64	-63	-65	-67	-69	-68	-66	-58	-50	-37	-28	-22	-14	-3	3	7	14	19
20	12	10	2	-3	-14	-22	-29	-36	-45	-61	-65	-76	-84	-95	-89	-86	-72	-68	-56	-45	-34	-27	-21	-12	-4	0	8	15	21
21	15	8	0	-4	-12	-21	-27	-34	-45	-56	-68	-72	-86	-89	-95	-84	-76	-65	-61	-45	-36	-29	-22	-14	-3	2	10	12	20
19	14	7	3	-3	-14	-22	-28	-37	-50	-58	-66	-68	-69	-67	-65	-63	-64	-57	-56	-48	-41	-26	-19	-17	-9	5	9	12	17
18	14	8	3	-8	-16	-21	-28	-40	-47	-51	-40	-39	-42	-52	-55	-44	-44	-45	-51	-47	-38	-27	-22	-16	-9	2	6	13	16
12	11	7	0	-9	-17	-22	-33	-43	-33	-34	-31	-33	-37	-44	-44	-37	-32	-26	-35	-26	-29	-33	-25	-15	-8	0	-3	-13	-16
14	12	5	-3	-9	-15	-18	-25	-21	-16	-9	-18	-24	-29	-35	-35	-29	-25	-17	-17	-15	-23	-22	-22	-17	-9	-4	7	13	16
7	1	-6	-11	-7	3	2	3	0	-4	-6	-16	-23	-33	-33	-24	-18	-12	-8	-6	-1	1	-9	-7	0	-2	4	5		
3	0	3	6	7	15	13	12	8	2	1	-8	-17	-24	-26	-16	-9	-7	-3	2	5	6	7	7	7	1	2	6		
5	5	17	26	24	19	19	16	14	9	5	2	-10	-21	-22	-14	0	4	7	13	15	17	23	25	24	22	9	15		
	19	32	30	32	29	26	26	22	17	12	8	-1	-16	-14	-6	4	9	13	20	20	25	27	29	33	35	28			
	36	39	37	37	32	30	27	21	16	11	4	-4	-4	0	8	13	21	24	26	30	33	35	38	38					
	42	42	41	37	32	32	28	26	20	13	3	3	11	17	24	27	32	35	40	40	40	43							
	46	45	43	40	39	37	32	22	17	6	9	14	22	28	34	36	41	45	47	46									
	45	44	45	41	39	34	27	23	9	11	16	27	34	36	41	46	48	50											
	48	48	46	42	39	34	25	13	12	24	34	39	42	47	48	49													
				45	41	33	26	18	19	31	39	43	46																

20765

Figure A58

Wavefront Plot - Q Polarization

Cube #4

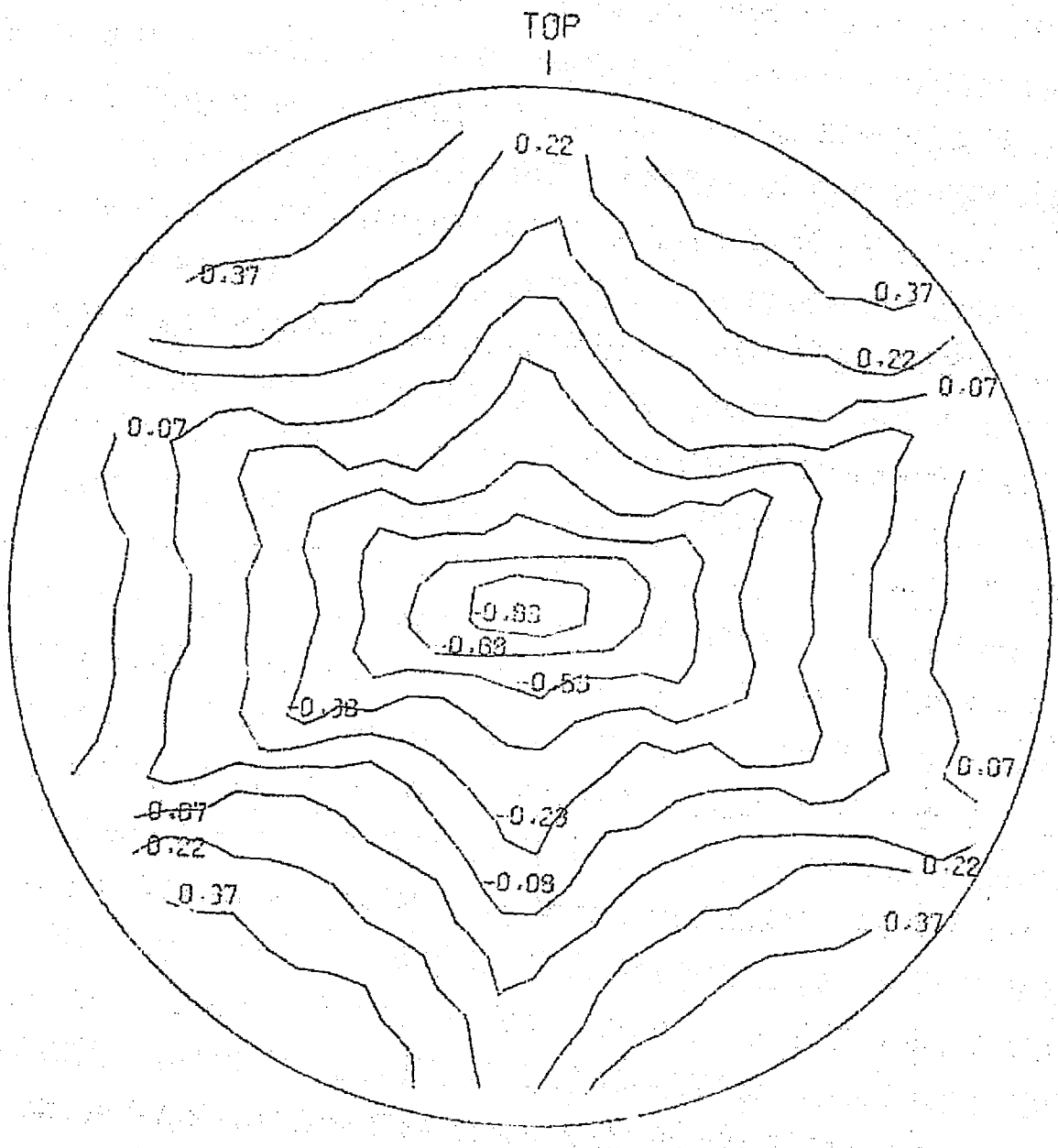


Figure A59

Wavefront Map - P Polarization

Cube #4

MAP IN UNITS OF 0.01 WAVES

105 101 97 89 78 26 35 41 50 53

108 105 105 101 97 92 83 71 21 33 42 48 51 54 56 56

108 106 104 99 95 93 85 75 69 18 31 36 43 48 50 53 53 54

104 105 103 100 94 92 87 80 73 67 15 26 31 40 45 47 49 51 53 54

102 99 99 99 93 90 86 82 75 70 61 12 21 28 34 36 41 41 45 50 50 51

96 96 93 91 89 84 82 79 72 67 59 53 4 12 20 25 30 35 38 41 45 45 48 44

86 93 91 88 85 83 79 79 71 68 62 52 43 -7 7 17 20 25 30 35 35 37 40 39 40 27

31 68 81 83 83 82 76 74 72 66 62 59 43 36 -12 -1 10 14 17 22 25 28 27 32 34 25 14 -28

22 18 17 65 65 66 64 64 60 55 50 48 41 31 -16 -9 0 10 11 17 20 21 23 15 15 -30 -34 -30

21 20 13 15 51 49 59 57 52 49 45 39 34 25 -24 -15 -7 -2 3 8 12 11 11 1 -45 -40 -32 -26

32 29 23 11 6 -1 -6 35 35 42 41 40 33 28 22 -26 -20 -16 -9 0 -7 -12 -17 -52 -49 -43 -37 -28 -21 -19

32 29 19 16 7 0 -9 -17 -13 31 23 32 26 21 13 -35 -28 -25 -23 -25 -25 -77 -67 -56 -51 -43 -34 -26 -22 -21

32 29 22 18 6 0 -6 -11 -22 -31 -35 13 14 13 3 -43 -34 -31 -32 -85 -81 -74 -62 -55 -50 -42 -30 -25 -19 -15

33 28 25 21 6 -1 -3 -10 -25 -32 -40 -41 -6 -5 -7 -59 -60 -60 -100 -92 -84 -71 -62 -56 -48 -37 -30 -26 -19 -14

36 28 26 18 12 1 -6 -13 -20 -29 -45 -49 -60 -68 -36 -81 -120 -106 -102 -90 -79 -68 -61 -55 -46 -38 -33 -25 -18 -12

37 31 24 16 11 3 -5 -11 -18 -29 -40 -52 -56 -70 -69 -24 -118 -110 -99 -95 -79 -70 -63 -56 -48 -37 -31 -23 -21 -13

35 30 23 19 12 1 -6 -12 -21 -34 -42 -50 -48 -49 -47 4 6 5 -91 -90 -82 -75 -60 -53 -51 -43 -28 -24 -21 -16

34 30 24 19 7 0 -5 -12 -24 -31 -35 -20 -19 -22 -32 14 25 25 25 -85 -81 -72 -61 -56 -50 -43 -31 -27 -20 -17

28 27 23 19 8 1 -6 -17 -27 -13 -14 -11 -19 -17 -23 -25 -33 -37 -44 -35 -48 -63 -67 -59 -49 -42 -33 -30 -20 -17

30 28 21 12 6 0 -2 -5 0 4 10 1 -4 -9 -15 34 40 44 52 52 54 46 47 -56 -51 -43 -38 -26 -20 -17

23 17 9 4 12 23 22 23 19 15 13 4 -3 -12 37 45 51 57 61 64 69 71 60 63 -34 -36 -29 -28

19 15 19 26 27 35 33 32 28 22 21 11 2 -4 43 53 60 62 66 72 76 76 77 77 77 -32 -31 -27

21 25 37 46 44 39 39 36 34 29 25 22 9 0 47 55 71 74 78 83 85 88 93 95 95 93 80 -18

39 52 50 52 49 47 46 42 37 32 28 18 3 55 64 74 79 83 90 90 95 97 100 103 105 98

56 59 57 57 52 50 47 41 36 31 24 15 65 71 79 83 91 94 96 101 103 105 108 108

62 62 62 57 53 52 48 46 40 33 23 73 81 87 94 98 102 105 110 111 111 114

66 65 63 60 59 57 52 42 37 26 79 85 92 98 104 106 112 115 117 116

66 65 65 61 59 55 48 43 29 81 86 97 104 107 111 116 118 120

68 68 66 62 59 54 45 33 82 94 104 109 112 117 118 119

65 62 53 46 38 90 101 109 113 117

Figure A60

Wavefront Plot - P Polarization

Cube #4

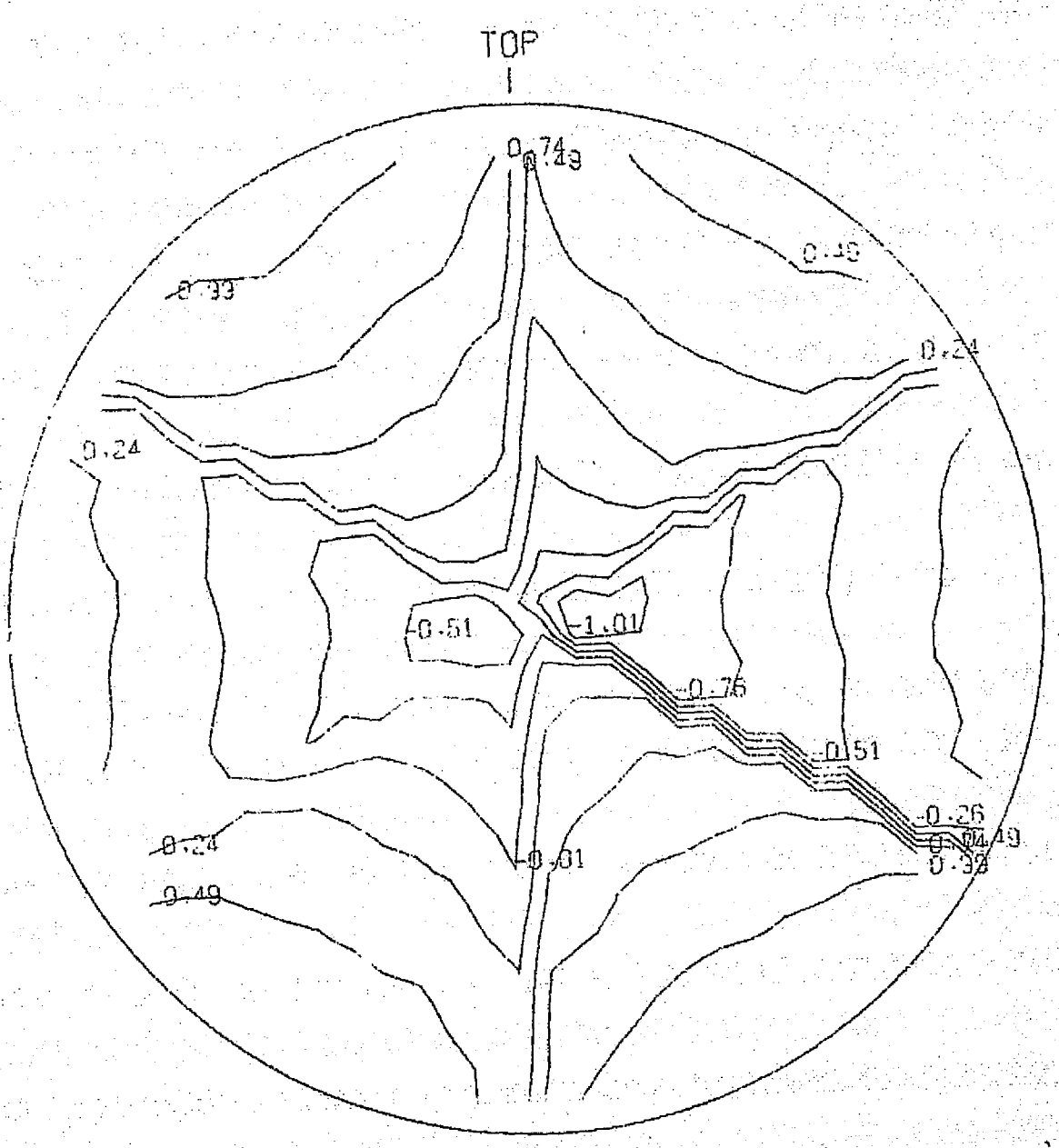


Figure A61

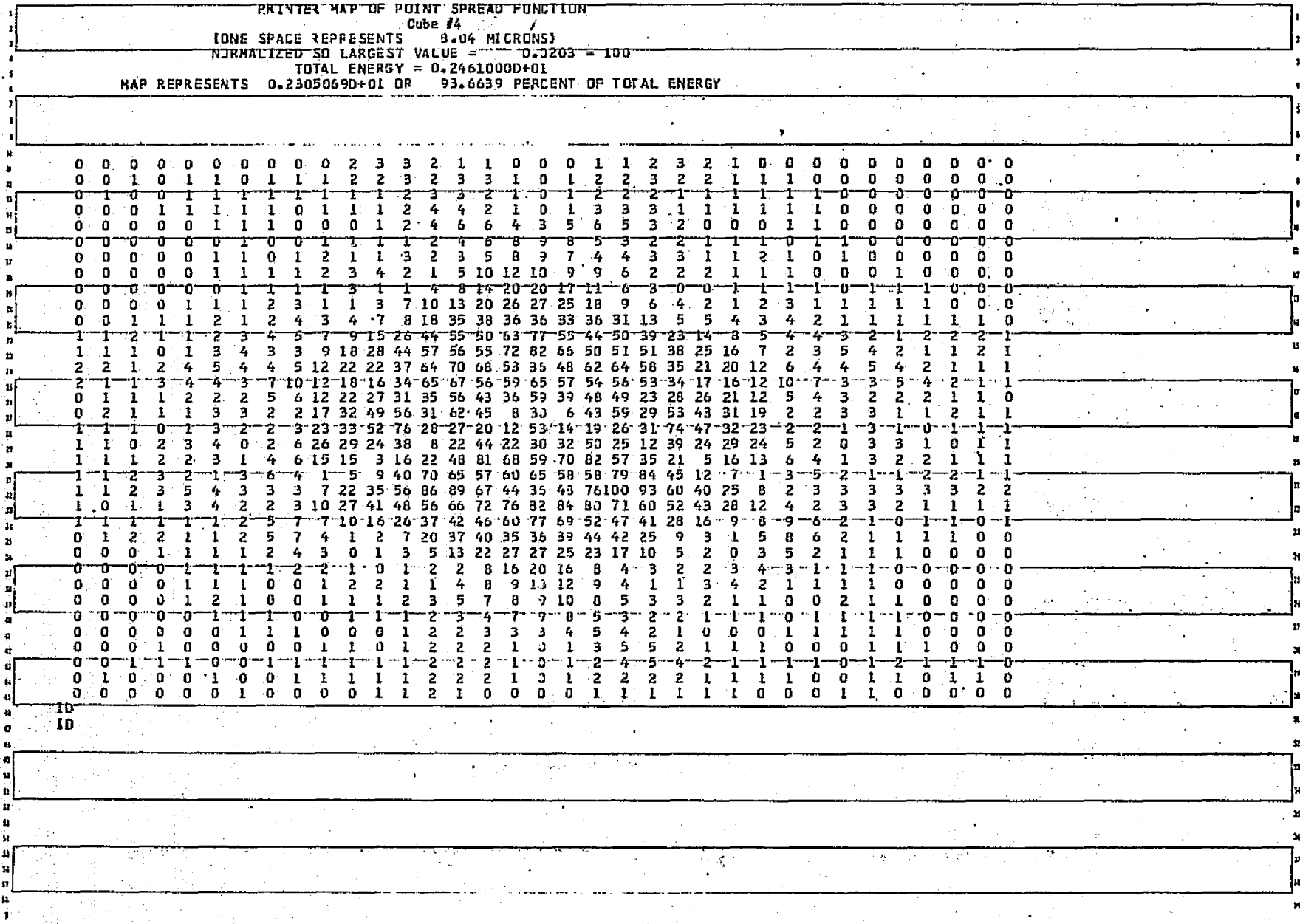


Figure A62

Point Spread Function

Cube #4

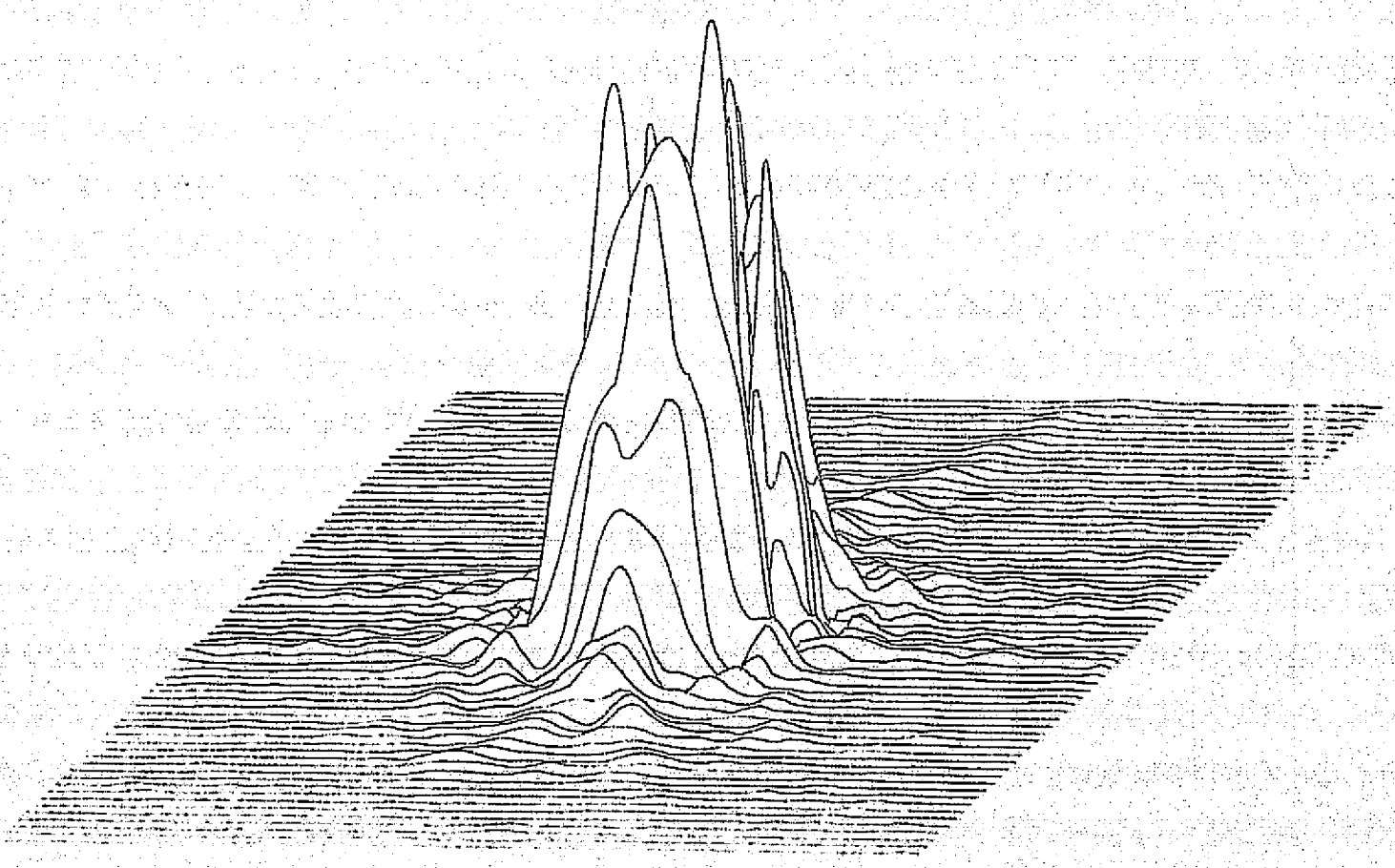
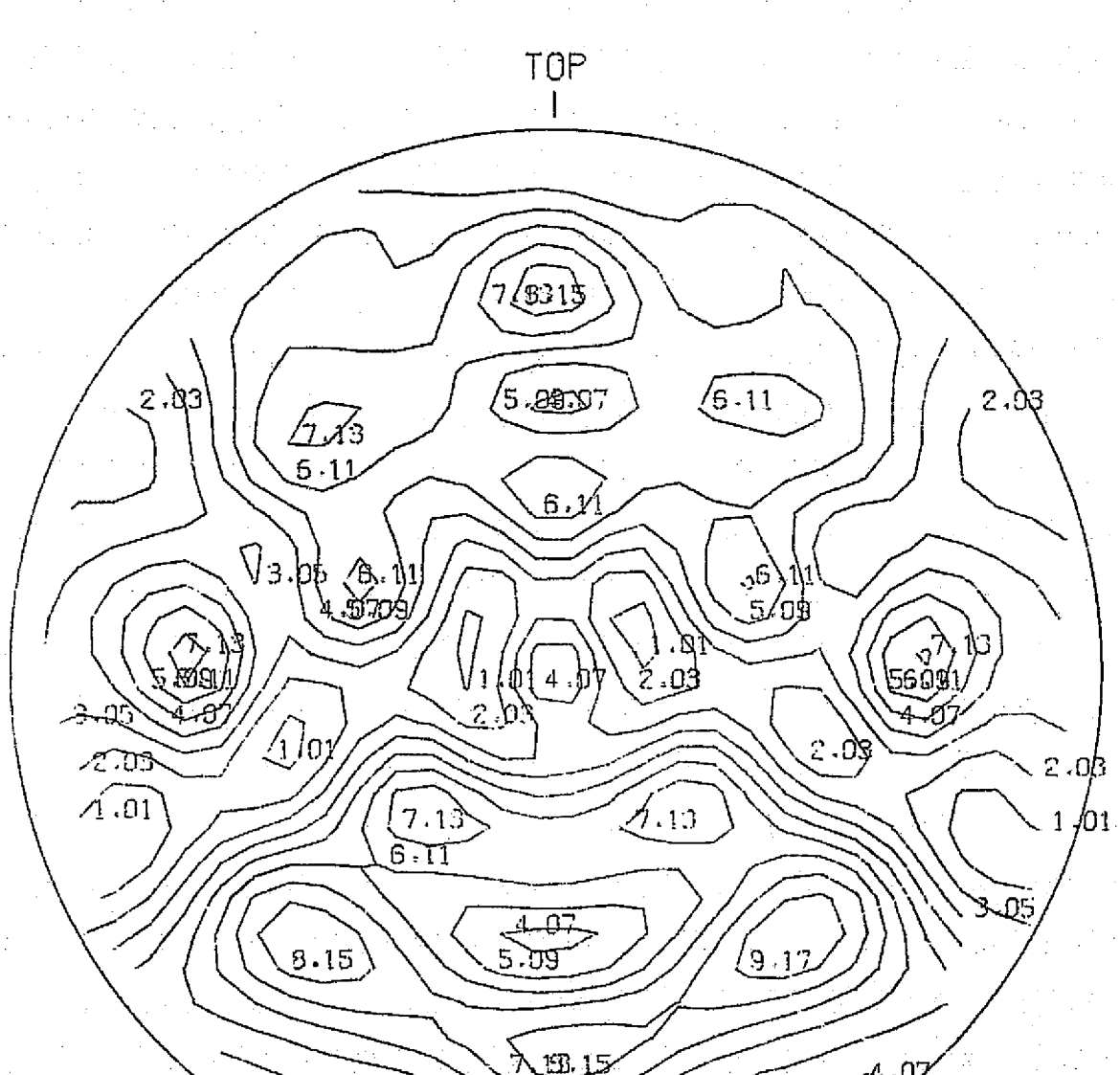


Figure A63

Intensity Distribution - Central 129 Microradians

Cube #4



46 1472

Figure A64

Encircled Energy
Vs
Field Angle

Cube #4

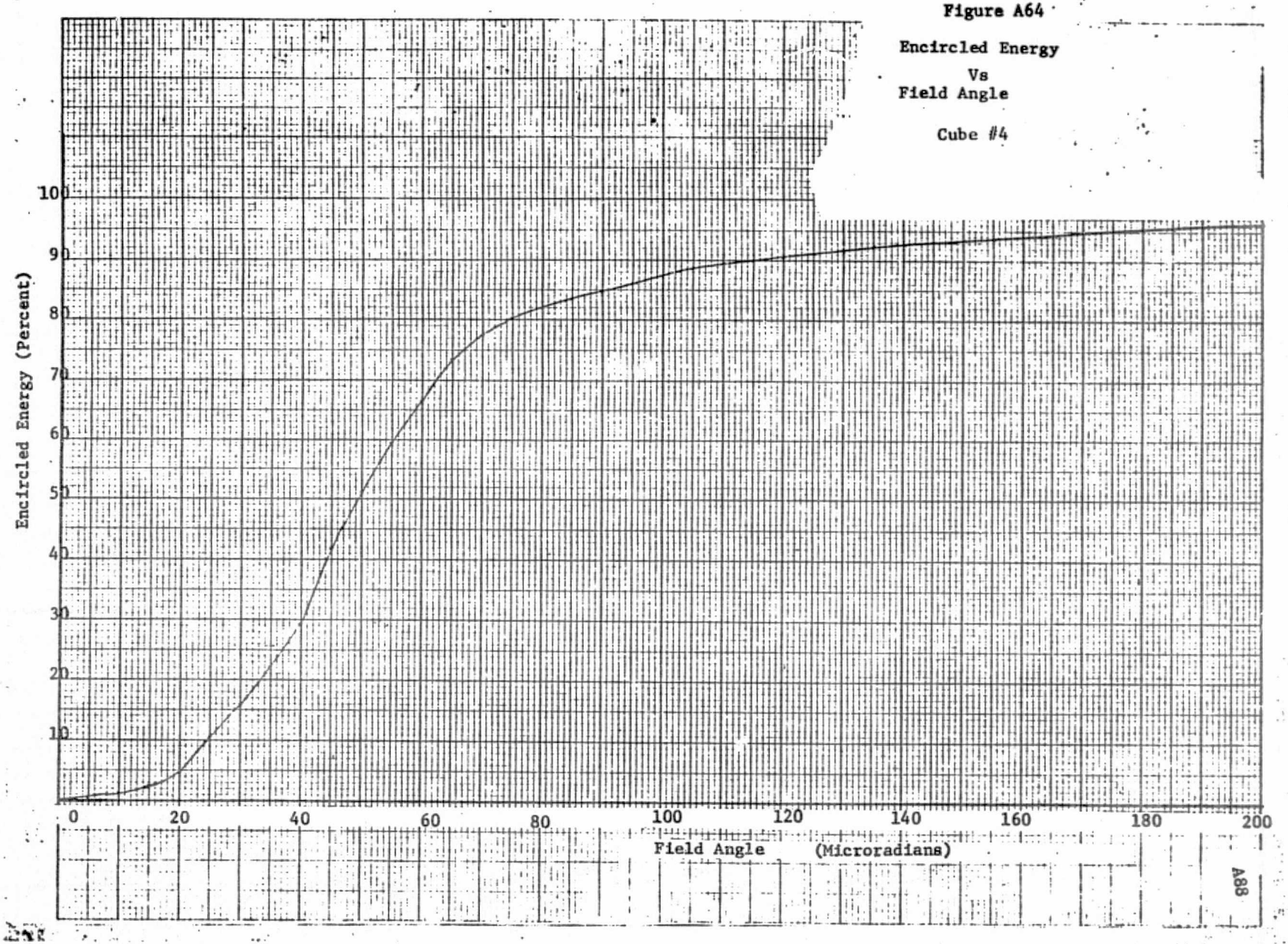


Table A24

ENCIRCLED ENERGY

Cube #4

CIRCLE RADIUS (MICRONS)	PERCENT ENERGY WITHIN CIRCLE CENTERED AT INDICATED COORDINATES								
CENTER (MICRONS): X=	-10.13	10.13	0.0	-10.13	0.0	10.13	0.0	-10.13	10.13
Y=	-10.13	-10.13	-10.13	0.0	0.0	0.0	10.13	10.13	10.13
2.00	0.0	0.0	0.1	0.0	0.1	0.0	0.1	0.0	0.0
4.00	0.2	0.2	0.1	0.0	0.1	0.1	0.1	0.3	0.4
6.00	0.2	0.2	0.5	0.2	0.7	0.2	0.5	0.3	0.4
8.00	0.6	0.6	0.9	0.5	0.7	0.5	1.0	1.1	1.2
10.00	0.9	1.0	1.1	0.7	1.1	0.8	1.5	1.5	1.6
12.00	2.3	2.3	1.8	1.4	1.3	1.5	2.4	2.9	3.1
14.00	2.3	2.3	2.5	2.4	1.9	2.6	3.5	2.9	3.1
16.00	4.1	4.1	3.3	3.2	2.4	3.4	4.5	4.6	4.8
18.00	4.9	4.9	4.3	4.4	4.6	4.6	5.7	5.5	5.7
20.00	6.4	6.4	5.7	5.7	4.6	5.8	6.9	6.9	7.2
22.00	7.2	7.1	7.3	7.4	7.7	7.5	8.4	7.7	8.0
24.00	9.2	9.0	8.6	8.4	9.2	8.5	9.5	9.7	10.1
26.00	10.3	10.0	10.7	10.5	12.2	10.6	11.2	10.8	11.4
28.00	13.2	12.8	13.6	13.2	13.1	13.3	14.2	13.7	14.4
30.00	15.1	14.7	15.7	15.4	15.9	15.4	15.9	15.8	16.5
32.00	19.3	18.9	18.4	17.8	17.6	17.9	19.0	19.8	20.6
34.00	20.2	19.8	21.1	20.9	19.8	21.0	21.9	20.9	21.6
36.00	24.7	24.3	24.2	23.7	22.8	23.8	25.5	25.3	25.9
38.00	26.8	26.6	26.8	26.8	27.2	26.9	28.3	27.8	28.2
40.00	30.5	30.3	30.0	29.8	29.3	29.9	32.0	31.6	31.9
42.00	32.4	32.3	33.7	33.9	35.1	34.0	35.8	33.7	33.8
44.00	36.3	36.3	36.3	36.1	38.2	36.2	38.5	37.8	37.8
46.00	39.0	39.1	40.3	40.9	44.2	41.0	42.4	40.8	40.8
48.00	42.6	42.7	44.5	44.8	45.7	44.8	46.4	44.5	44.4
50.00	45.8	45.8	47.3	48.1	51.1	48.1	48.8	47.7	47.6
52.00	49.7	49.8	51.2	52.0	53.5	52.0	52.6	51.5	51.3
54.00	52.0	52.0	54.4	55.7	57.5	55.6	55.5	53.6	53.6
56.00	56.2	56.3	58.5	59.5	60.1	59.5	59.5	57.5	57.4
58.00	59.2	59.2	60.8	61.9	64.0	61.9	61.8	60.2	60.2
60.00	62.3	62.3	64.1	65.1	66.6	65.1	65.0	63.1	63.0
62.00	64.4	64.4	66.6	67.7	69.6	67.7	67.4	65.2	65.1
64.00	67.7	67.8	68.8	69.6	71.9	69.6	69.7	68.3	68.1
66.00	69.6	69.6	71.3	72.2	74.5	72.2	72.1	70.1	70.0
68.00	72.0	72.1	73.5	73.9	75.6	73.8	74.0	72.6	72.4
70.00	73.5	73.5	75.3	75.7	77.6	75.6	75.6	73.9	73.8
72.00	75.7	75.7	76.9	77.1	78.7	77.0	77.1	76.0	75.9
74.00	76.7	76.8	78.5	78.6	79.9	78.5	78.3	77.0	76.8
76.00	78.6	78.6	79.9	79.8	80.6	79.7	79.5	78.7	78.5
78.00	79.7	79.7	80.6	80.7	81.4	80.6	80.2	79.7	79.5
80.00	80.8	80.9	81.6	81.5	82.0	81.5	81.3	80.9	80.7

Table A25

ENCIRCLED ENERGY

Cube #4

CIRCLE RADIUS (MICRONS)	PERCENT ENERGY WITHIN CIRCLE CENTERED AT INDICATED COORDINATES								
CENTER (MICRONS): X=	-10.13	10.13	0.0	-10.13	0.0	10.13	0.0	-10.13	10.13
Y=	-10.13	-10.13	-10.13	0.0	0.0	0.0	10.13	10.13	10.13
5.00	0.2	0.2	0.3	0.1	0.4	0.2	0.4	0.3	0.4
10.00	0.9	1.0	1.1	0.7	1.1	0.8	1.5	1.5	1.6
15.00	3.4	3.4	3.1	2.8	2.4	2.9	4.1	3.9	4.1
20.00	6.4	6.4	5.7	5.7	4.6	5.8	6.9	6.9	7.2
25.00	9.9	9.7	10.2	10.3	10.4	10.4	10.9	10.5	11.0
30.00	15.1	14.7	15.7	15.4	15.9	15.4	15.9	15.8	16.5
35.00	22.9	22.5	22.5	21.9	22.0	22.0	23.3	23.4	24.0
40.00	30.5	30.3	30.0	29.8	29.3	29.9	32.0	31.6	31.9
45.00	37.7	37.7	38.6	39.3	41.8	39.3	40.7	39.4	39.4
50.00	45.8	45.8	47.3	48.1	51.1	48.1	48.8	47.7	47.6
55.00	54.7	54.8	56.7	57.7	59.5	57.6	57.8	56.1	56.0
60.00	62.3	62.3	64.1	65.1	66.6	65.1	65.0	63.1	63.0
65.00	68.6	68.6	70.4	71.2	73.5	71.2	71.2	69.1	69.0
70.00	73.5	73.5	75.3	75.7	77.6	75.6	75.6	73.9	73.8
75.00	77.8	77.8	79.2	79.2	80.3	79.2	79.0	78.0	77.9
80.00	80.8	80.9	81.6	81.5	82.0	81.5	81.3	80.8	80.7
85.00	82.9	82.9	83.3	83.3	83.5	83.3	83.2	82.8	82.7
90.00	84.3	84.4	84.6	84.7	84.7	84.7	84.7	84.4	84.4
95.00	85.7	85.8	85.8	85.9	86.0	86.0	86.0	85.8	85.9
100.00	86.9	87.0	87.0	87.1	87.3	87.1	87.0	86.9	86.9
105.00	87.9	88.0	88.1	88.1	88.4	88.2	88.0	87.9	87.9
110.00	88.8	88.9	89.1	89.0	89.3	89.1	88.9	88.8	88.8
115.00	89.7	89.8	89.8	89.8	89.9	89.8	89.7	89.7	89.7
120.00	90.4	90.4	90.5	90.4	90.5	90.5	90.5	90.4	90.4
125.00	91.0	91.0	91.1	91.0	91.1	91.1	91.1	91.0	91.0
130.00	91.6	91.6	91.6	91.6	91.7	91.6	91.7	91.6	91.6
135.00	92.0	92.0	92.1	92.1	92.3	92.1	92.2	92.1	92.1
140.00	92.5	92.5	92.5	92.7	92.6	92.6	92.7	92.6	92.6
145.00	92.9	92.9	92.9	93.1	93.0	93.0	93.1	93.0	93.0
150.00	93.3	93.3	93.3	93.4	93.4	93.4	93.4	93.4	93.4
155.00	93.7	93.7	93.8	93.7	93.7	93.7	93.8	93.7	93.8
160.00	94.1	94.1	94.1	94.0	94.0	94.1	94.0	94.1	94.1
165.00	94.4	94.4	94.5	94.4	94.4	94.4	94.4	94.4	94.4
170.00	94.7	94.7	94.8	94.8	94.8	94.8	94.8	94.7	94.7
175.00	95.0	95.0	95.0	95.1	95.1	95.1	95.1	95.1	95.1
180.00	95.3	95.3	95.3	95.4	95.4	95.4	95.4	95.4	95.4
184.99	95.6	95.6	95.5	95.6	95.6	95.6	95.7	95.7	95.7
189.99	95.8	95.8	95.8	95.9	95.9	95.9	95.9	95.9	95.9
194.99	96.1	96.1	96.1	96.1	96.1	96.1	96.1	96.1	96.2
199.99	96.3	96.3	96.3	96.3	96.3	96.3	96.4	96.4	96.4

Figure A65

Wavefront Map - Q Polarization

Cube #5

MAP IN UNITS OF 0.01 WAVES

										-47	-43	-40	-32	-26	-28	-35	-44	-45	-48										
							54	52	49	42	40	36	24	22	25	33	39	38	43	46	49	54							
						50	50	47	42	38	36	31	22	16	19	26	35	37	38	42	46	52	54							
					-46	-45	-43	-37	-31	-30	-27	-24	-16	-7	-13	-24	-25	-29	-34	-36	-43	-48	-50	-55						
				46	44	41	39	32	28	25	17	16	8	3	0	10	21	24	30	34	39	44	47	48	53					
			36	37	38	37	31	26	20	19	11	6	4	0	-2	5	13	17	22	25	32	35	38	41	45	46				
		-23	-25	-26	-26	-23	-16	-16	-13	-10	-4	0	-4	-11	-10	-3	0	9	-14	-20	-25	-29	-32	-37	-41	-43	-44			
	11	13	17	20	20	16	11	9	3	1	-3	-9	-15	-19	-21	-11	-5	0	9	13	17	20	24	29	28	22	33	30		
	5	6	6	1	11	7	5	4	-1	-5	-8	-16	-22	-26	-25	-18	-12	-7	0	0	7	10	16	15	11	8	13	18		
	-8	0	-2	-6	-8	-11	-6	-4	-10	-15	-19	-24	-29	-36	-35	-28	-21	-16	-10	-5	-1	0	-1	-1	-1	-2	-12	-15		
20	16	7	2	-8	-17	-24	-29	-32	-25	-27	-28	-34	-43	-49	-43	-34	-30	-26	-19	-12	-9	-10	-9	-12	-5	3	13	19	23	
23	18	9	2	-7	-15	-29	-37	-42	-41	-39	-44	-44	-50	-54	-54	-44	-40	-33	-35	-33	-34	-27	-22	-11	-2	9	17	19	28	
26	19	12	2	-6	-12	-26	-38	-54	-56	-59	-56	-53	-57	-67	-61	-60	-51	-58	-54	-45	-38	-31	-22	-8	-1	7	15	23	30	
27	20	13	4	-2	-12	-22	-35	-52	-57	-71	-76	-77	-85	-74	-84	-82	-76	-75	-63	-53	-40	-31	-21	-12	0	6	14	23	29	
26	18	11	6	-5	-12	-21	-29	-45	-54	-67	-81	-87	-111	-115	-116	-98	-84	-78	-65	-60	-39	-32	-21	-12	-2	7	15	24	27	
27	24	15	7	-2	-12	-21	-32	-39	-60	-65	-78	-84	-98	-116	-115	-111	-87	-81	-67	-54	-45	-29	-21	-12	-5	6	11	18	26	
29	23	14	6	0	-12	-21	-31	-40	-53	-63	-75	-76	-82	-84	-74	-85	-77	-76	-71	-57	-52	-35	-22	-12	-2	4	13	20	27	
30	23	15	7	1	-8	-22	-31	-38	-45	-54	-58	-51	-60	-61	-67	-57	-53	-56	-59	-56	-54	-38	-26	-12	-6	2	12	19	26	
28	19	17	9	-2	-11	-22	-27	-34	-33	-35	-33	-40	-44	-54	-54	-50	-44	-44	-39	-41	-42	-37	-29	-15	-7	2	9	18	23	
23	19	13	3	-5	-12	-9	-10	-9	-12	-19	-26	-30	-34	-43	-49	-43	-34	-28	-27	-25	-32	-29	-24	-17	-8	2	7	16	20	
	15	12	2	1	-1	1	0	-1	-5	-10	-16	-21	-28	-35	-36	-29	-24	-19	-15	-10	-4	-6	-11	-8	-6	-2	0	8		
	18	13	8	11	15	16	10	7	0	0	-7	-12	-18	-25	-26	-22	-16	-8	-5	-1	4	5	7	11	1	6	6	5		
	30	33	22	28	29	24	20	17	13	9	0	-5	-11	-21	-19	-15	-9	-3	1	3	9	11	16	20	20	17	13	11		
		44	43	41	37	32	29	25	20	14	9	0	-3	-10	-11	-4	0	4	10	13	16	16	23	26	26	25	23			
			46	45	41	38	35	32	25	22	17	13	5	-2	0	4	6	11	19	20	26	31	37	38	37	36				
				53	48	47	44	39	34	30	24	21	10	0	3	8	16	17	25	28	32	39	41	44	46					
					55	50	48	43	36	34	29	25	24	13	7	16	24	27	30	31	37	43	45	46						
						54	52	46	42	38	37	35	26	19	16	22	31	36	38	42	47	50	50							
							54	49	46	43	38	39	33	25	22	24	36	40	42	49	52	54							
										48	45	44	35	28	26	32	40	43	47										

Figure A66

Wavefront Plot - Q Polarization

Cube #5

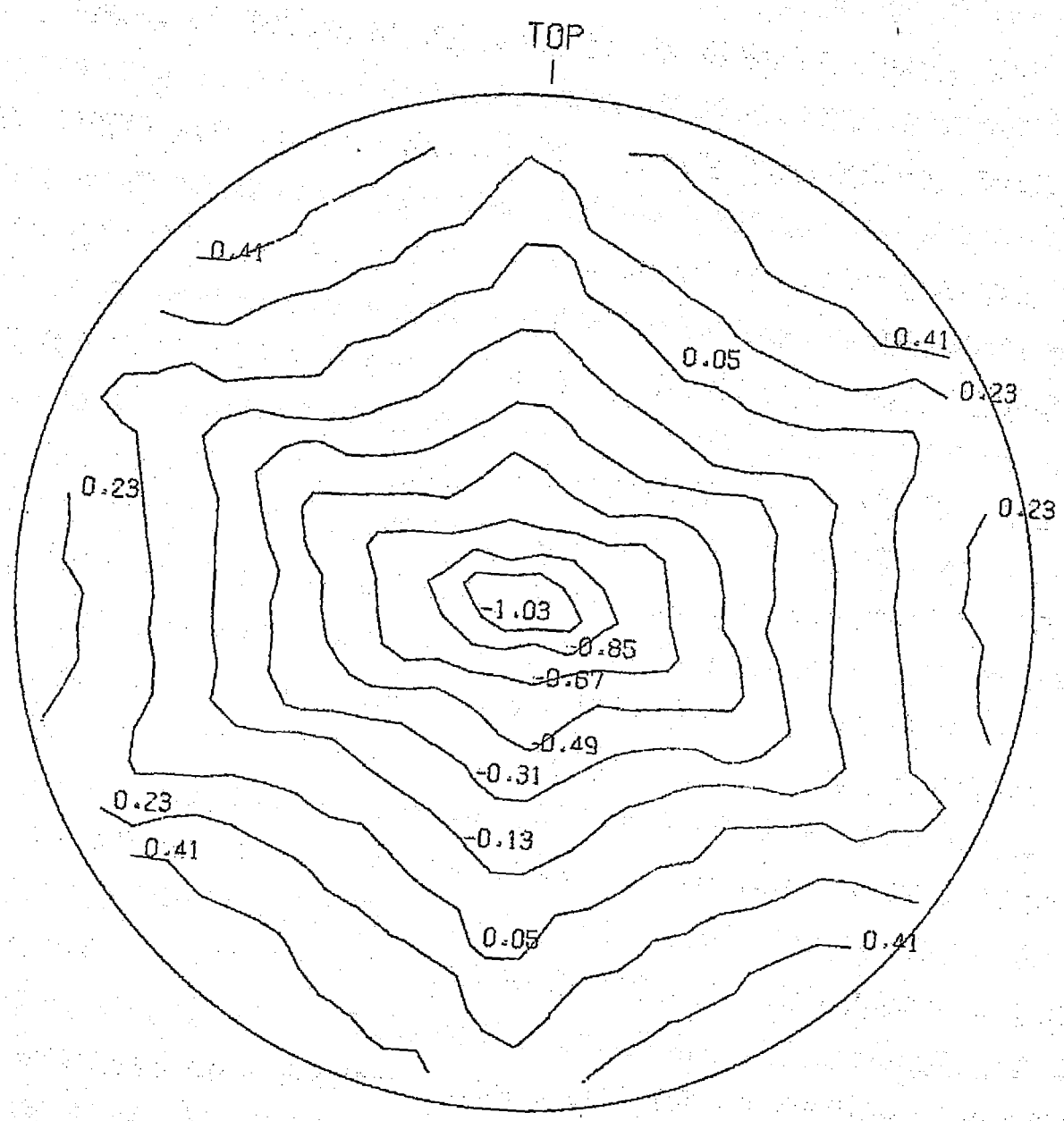


Figure A67

Wavefront Map - P Polarization

Cube #5

MAP IN UNITS OF 0.01 WAVES

105 102 99 90 85 36 43 53 54 56

113 110 107 101 98 95 83 81 34 42 47 47 52 54 58 62

109 108 105 100 97 94 89 81 75 28 34 43 45 47 50 55 61 63

105 104 101 96 89 88 85 82 75 66 21 32 39 38 42 45 51 57 58 63

104 103 100 98 91 86 84 76 75 67 61 7 18 30 32 38 43 48 52 56 56 61

95 95 97 95 90 85 79 77 69 65 63 57 6 14 22 25 30 33 41 43 47 50 54 55

82 83 85 85 81 75 75 72 69 62 57 53 47 -1 5 8 18 22 28 34 38 41 46 49 51 52

27 72 75 78 79 75 69 68 62 59 55 49 43 38 -13 -3 3 8 18 21 26 29 33 38 37 31 41 -3

21 22 22 59 70 66 64 63 56 52 49 42 36 31 -17 -9 -4 0 8 8 16 19 24 23 20 -25 -20 -15

24 15 13 9 49 46 51 54 48 43 39 34 28 22 -27 -20 -12 -8 -2 2 6 8 9 7 32 31 21 18

36 32 23 18 7 -1 -8 29 26 33 31 29 24 15 9 -35 -25 -22 -17 -11 -4 0 -2 -43 -46 -39 -30 -20 -14 -10

39 34 25 18 8 0 -13 -21 -26 17 18 14 13 8 4 -46 -36 -32 -25 -27 -25 -68 -61 -56 -45 -36 -24 -16 -14 -5

42 35 28 18 9 3 -10 -22 -38 -40 -43 2 4 1 -8 -53 -51 -43 -49 -88 -79 -72 -65 -56 -42 -32 -26 -18 -10 -3

43 36 29 20 13 3 -6 -19 -36 -41 -55 -60 -18 -27 -16 -75 -74 -67 -109 -97 -87 -74 -65 -55 -46 -34 -27 -19 -10 -4

42 34 27 22 10 3 -5 -13 -29 -38 -51 -65 -71 -95 -56 -107 -132 -118 -112 -99 -94 -73 -66 -55 -46 -36 -26 -18 -9 -6

43 40 31 23 13 3 -5 -16 -23 -44 -49 -62 -68 -82 -96 -45 -145 -121 -115 -101 -88 -79 -69 -55 -46 -39 -27 -22 -15 -7

45 39 30 22 15 3 -5 -15 -24 -37 -47 -59 -55 -62 -64 -4 -15 -7 -110 -105 -91 -86 -69 -56 -46 -36 -29 -20 -13 -6

46 39 31 23 17 7 -6 -15 -22 -29 -38 -37 -31 -40 -41 3 12 16 13 -93 -90 -88 -72 -60 -46 -40 -31 -21 -14 -7

44 35 33 25 13 4 -6 -11 -18 -13 -15 -13 -20 -24 -34 15 19 25 25 30 28 -76 -71 -63 -49 -41 -31 -24 -15 -10

39 35 29 19 10 3 6 9 10 7 0 -6 -10 -13 -23 20 26 35 41 42 44 37 41 -58 -51 -42 -31 -26 -17 -13

31 28 18 17 19 21 20 18 14 9 3 -1 -8 -15 34 40 46 51 55 60 65 63 58 61 -40 -36 -34 -25

34 29 24 31 35 36 30 27 20 20 12 7 1 -5 43 47 53 61 64 68 74 75 78 81 71 27 27 28

46 53 42 48 49 45 41 37 33 29 19 14 8 -1 50 54 60 67 71 74 80 81 87 90 90 87 83 -22

64 63 61 57 52 49 45 40 34 29 20 16 9 59 65 69 74 81 84 86 87 93 96 96 95 93

67 65 61 58 55 52 45 42 37 33 25 17 69 75 77 81 89 91 96 101 107 109 107 107

73 68 68 64 59 54 50 44 41 30 19 73 78 86 87 95 98 102 109 111 114 116

75 70 68 63 56 54 49 45 44 33 77 87 94 97 100 101 108 113 116 116

74 72 66 62 59 57 55 46 39 87 92 101 106 108 112 117 120 120

74 69 66 63 58 59 53 45 92 95 106 110 113 119 122 124

68 65 65 55 48 97 102 110 113 117

Figure A68

Wavefront Plot - P Polarization

Cube #5

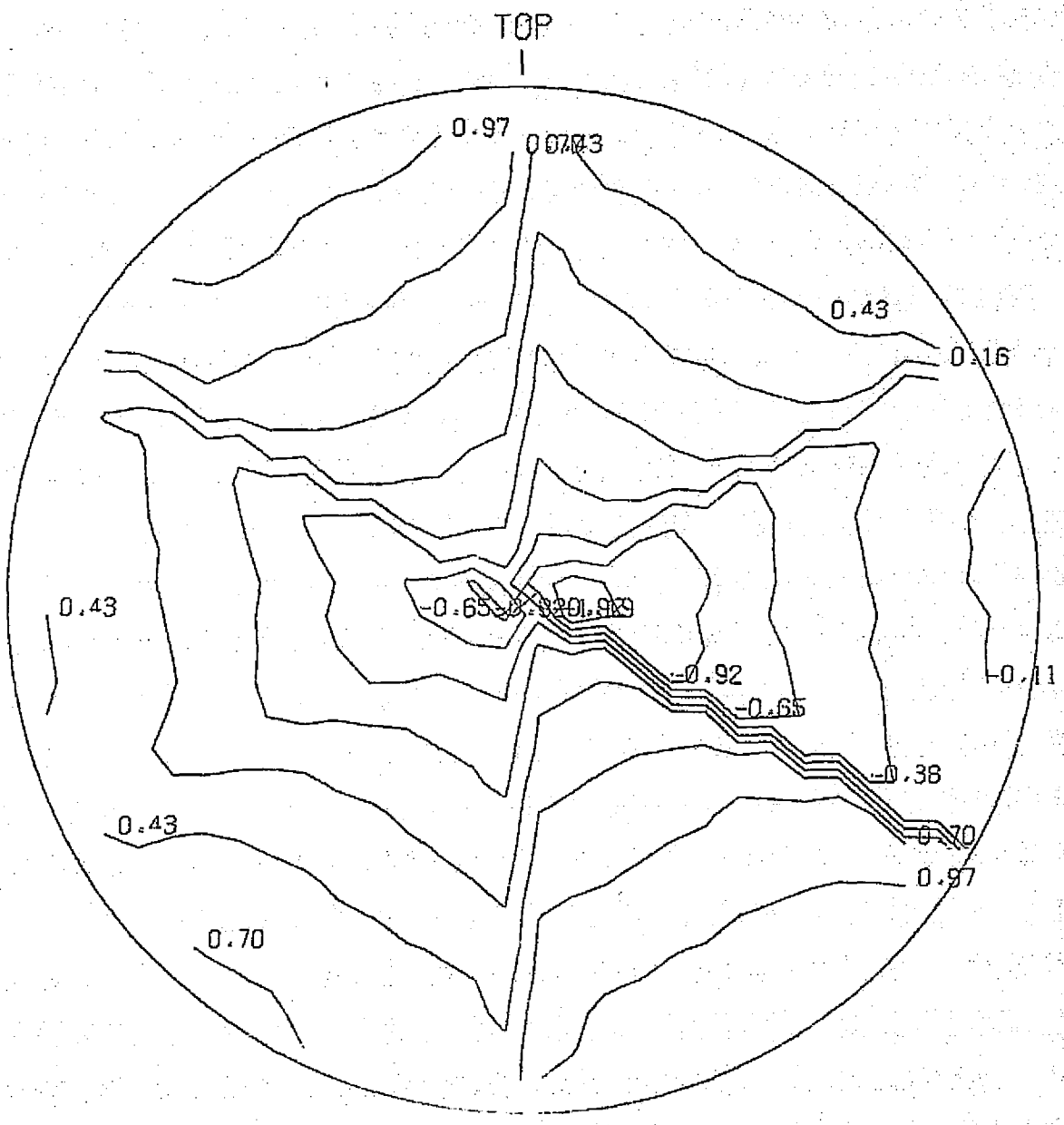


Figure A69

PRINTER MAP OF POINT SPREAD FUNCTION
Cube #5
(ONE SPACE REPRESENTS 8.04 MICRONS)
NORMALIZED SO LARGEST VALUE = 0.0182 = 100
TOTAL ENERGY = 0.2461000D+01
MAP REPRESENTS 0.2303980D+01 OR 93.6197 PERCENT OF TOTAL ENERGY

```
                0  0  0  0  0  0  0  0  1  0  1  2  2  2  2  2  1  0  1  2  3  3  3  1  1  0  1  1  0  0  0  1  1  0  0
                0  0  0  0  0  0  0  0  1  1  1  1  2  3  3  2  1  2  4  5  3  2  1  1  0  1  1  0  0  0  0  0  1  0  0
                0  0  0  0  0  0  0  0  1  1  0  1  0  0  1  1  2  2  2  3  4  2  1  1  1  0  0  1  2  1  0  0  0  0  1  0
                0  0  0  0  0  0  0  1  1  1  1  1  0  1  1  2  3  3  3  3  3  2  3  2  1  0  1  0  1  1  0  0  0  0  0  0
                0  0  0  0  0  1  0  0  1  1  1  1  2  2  4  7  8  7  6  6  6  5  3  3  2  1  1  1  0  1  1  0  0  0  0  0
                0  0  0  0  1  1  0  0  0  2  3  2  2  1  2  6 13 18 15  9  6  3  2  4  4  2  0  1  1  1  2  1  0  0  0
                0  0  0  0  0  0  0  0  1  3  2  1  2  1  1  4  9 17 15  8  4  1  2  2  2  4  1  0  1  1  1  1  0  0  0
                0  0  0  0  0  0  0  0  1  1  1  1  1  1  1  5 10  9 11 13 11  8  3  1  1  0  2  2  1  0  0  0  0  0  0  0
                0  0  0  0  0  1  1  1  1  1  0  1  5 11 15 17 16 19 22 18 15 14  7  2  1  1  3  2  1  1  0  0  0  1  0
                0  0  0  0  1  2  2  2  2  1  2  8 18 26 31 35 33 30 35 34 26 24 20 11  3  3  4  3  3  2  1  0  0  1  1
                0  0  1  2  2  1  2  3  4  3  7 15 23 36 59 65 45 30 37 56 58 38 25 20 11  7  5  3  3  3  2  1  0  1  1
                0  1  2  3  2  2  4  7  6  5 10 20 35 58 80 70 56 61 54 58 78 68 44 29 18 10  6  5  5  3  2  2  2  2  1
                0  1  1  1  2  4  5  6  4  5 15 28 40 56 63 58 65 81 73 58 66 70 55 38 24 10  5  5  5  3  2  1  2  1  1
                1  1  1  1  3  3  3  3  4 10 21 22 28 45 53 54 41 27 43 64 74 67 40 34 32 13  6  5  3  3  2  1  1  2  1
                1  1  1  2  2  1  1  5  9 14 19 15 27 39 41 45 39 35 42 47 61 63 33 28 35 20 15  8  2  2  3  2  0  2  1
                0  0  0  1  1  1  1  6 10 19 23 21 28 17 31 40 22 36 34 35 39 30 30 34 35 23 18  8  0  0  1  2  0  1  0
                0  1  1  1  0  1  1  5 10 30 38 37 47 21 41 36  6 32 10 29 45 27 52 53 42 30 15  6  2  1  0  2  2  2  0
                0  1  1  1  0  1  2  6 12 37 47 47 60 22 17 11 19 70 21 11 21 25 66 52 46 38 13  6  2  1  1  1  1  1  0
                1  1  0  2  2  2  1  7 15 35 47 35 34  9 17 34 24 32 26 42 20 11 38 25 39 37 13  6  1  1  2  2  0  0  1
                1  1  0  2  2  1  1  9 16 21 29 15 18 30 42 65 59 36 42 62 35 22 21  6 21 19  9  7  1  1  1  1  0  0  0
                0  1  1  2  1  0  2  8 10  6 18 23 44 79 69 44 40 36 31 34 45 54 35 13 11  4  3  5  2  1  0  1  1  1  0
                1  2  2  3  2  2  2  3  2  6 32 56 70 95100 69 37 29 42 61 72 64 45 35 24  6  1  1  1  2  3  2  2  1  1
                1  1  1  1  2  1  1  2  5 12 34 61 74 75 75 77 81 81 78 77 70 55 46 38 23  9  5  3  1  2  2  1  1  0  0
                1  1  2  2  1  1  2  7 13 17 22 35 58 75 69 55 57 60 58 68 78 67 42 20  9  8 11  9  3  1  1  1  2  1  1
                0  1  1  1  1  3  5  8 12 12 11 16 31 57 75 61 36 31 47 70 74 53 28 11  4  4  8  7  3  2  2  2  1  1  0
                0  0  0  0  1  3  6  5  6  4  2  9 17 25 35 39 34 32 35 36 31 24 17  9  2  1  3  2  2  3  2  1  0  0  0
                0  0  0  0  0  2  3  3  2  1  0  2  8 10  9 13 20 20 15 12 11 10  7  2  1  1  1  2  2  1  0  0  0  0  0
                0  0  0  0  0  1  1  2  2  1  1  1  1  3  5 10 13 12 11 10  5  1  1  1  1  1  0  1  1  1  1  0  0  0  0
                0  0  1  1  1  1  1  0  1  3  3  2  2  1  3 10 16 17 11  6  2  1  2  2  2  1  1  0  1  1  1  1  1  0  0
                0  0  0  2  2  1  1  1  0  2  4  3  2  1  3  8 15 18 11  4  1  1  2  3  3  1  0  0  0  0  0  1  1  0  0
                0  0  0  1  1  1  1  1  1  0  2  2  1  2  5  6  6  7  7  4  1  1  2  2  1  1  1  0  0  0  0  0  0  0  0
                1  0  0  0  0  0  1  1  0  0  0  0  0  2  4  4  3  3  3  3  3  2  1  1  0  0  1  0  0  0  0  0  0  0  0
                1  1  1  0  0  0  1  1  0  0  0  1  3  3  2  2  3  2  2  2  2  1  1  1  0  0  1  1  0  0  0  0  1  1  0
                0  1  1  0  0  0  0  1  1  0  0  1  1  1  3  4  2  1  2  3  2  1  0  1  1  1  1  1  0  0  0  0  0  0  0
                0  0  1  1  0  0  0  0  0  0  0  0  1  1  2  3  2  1  0  1  2  2  2  2  1  0  1  1  0  0  0  0  0  0  0  0
ID
ID
```

Figure A70

Point Spread Function

Cube #5

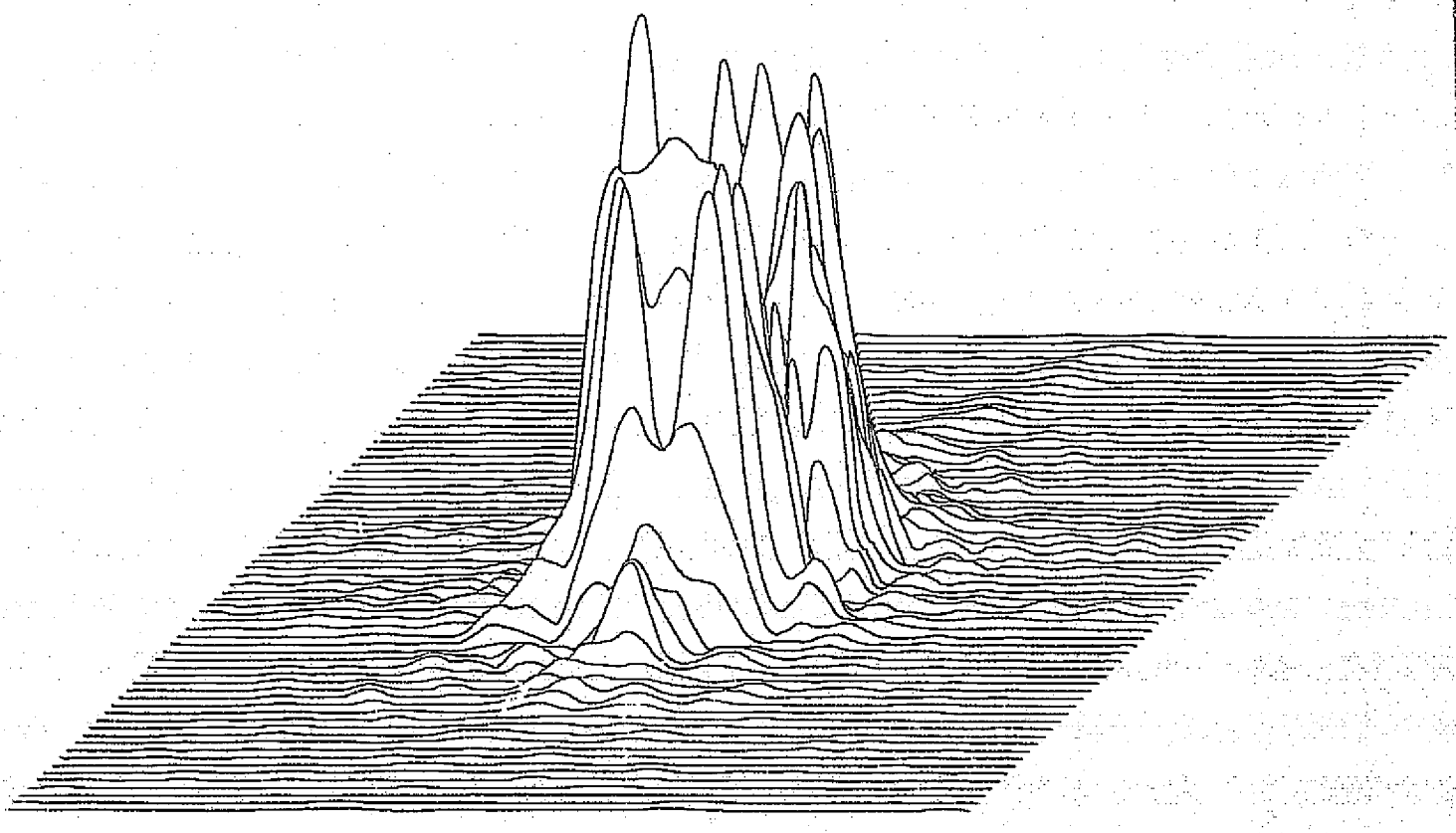


Figure A71

Intensity Distribution - Central 1.29 Microradians

Cube #5

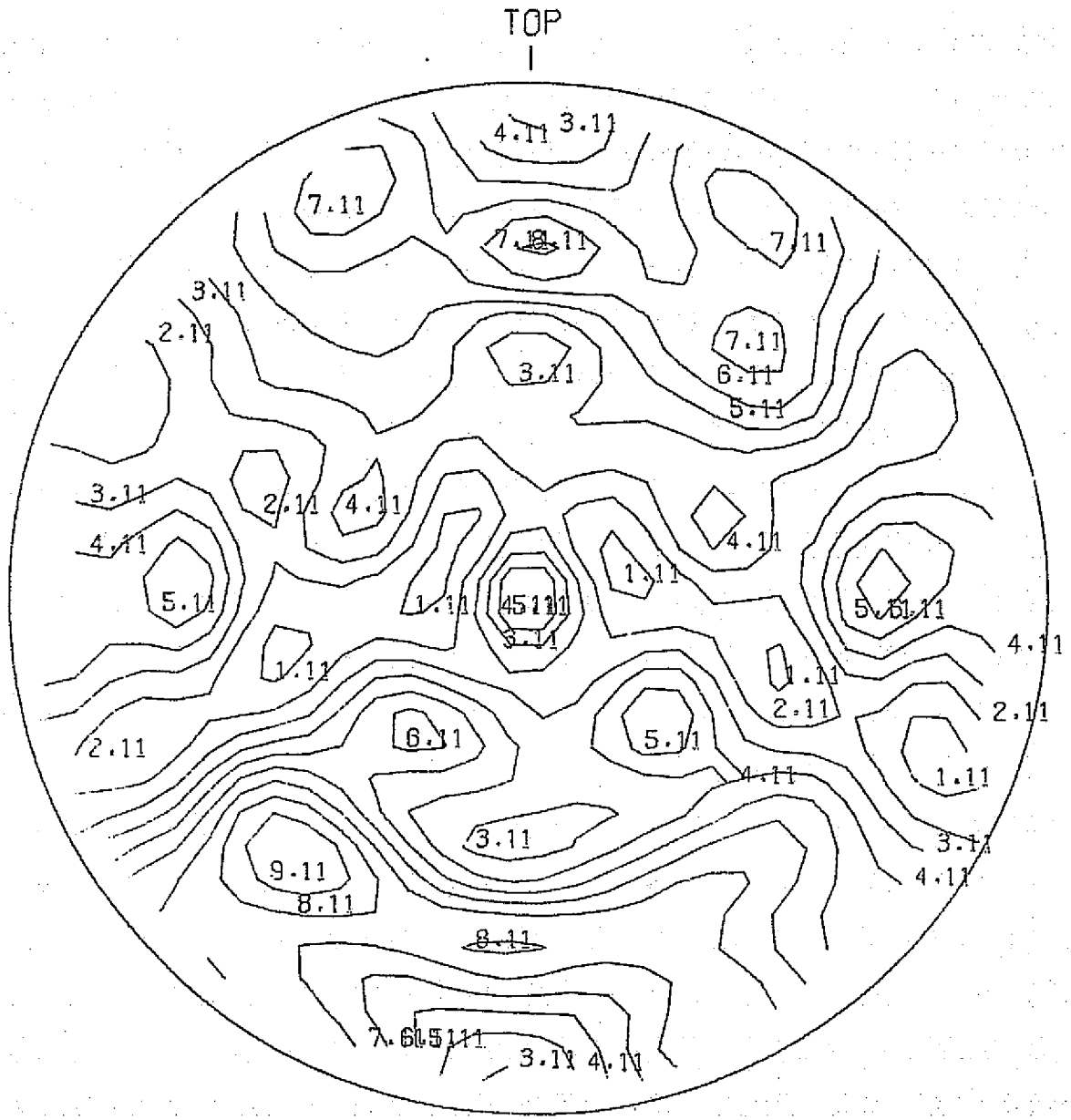


Figure A72

Encircled Energy
Vs
Field Angle

Cube #5

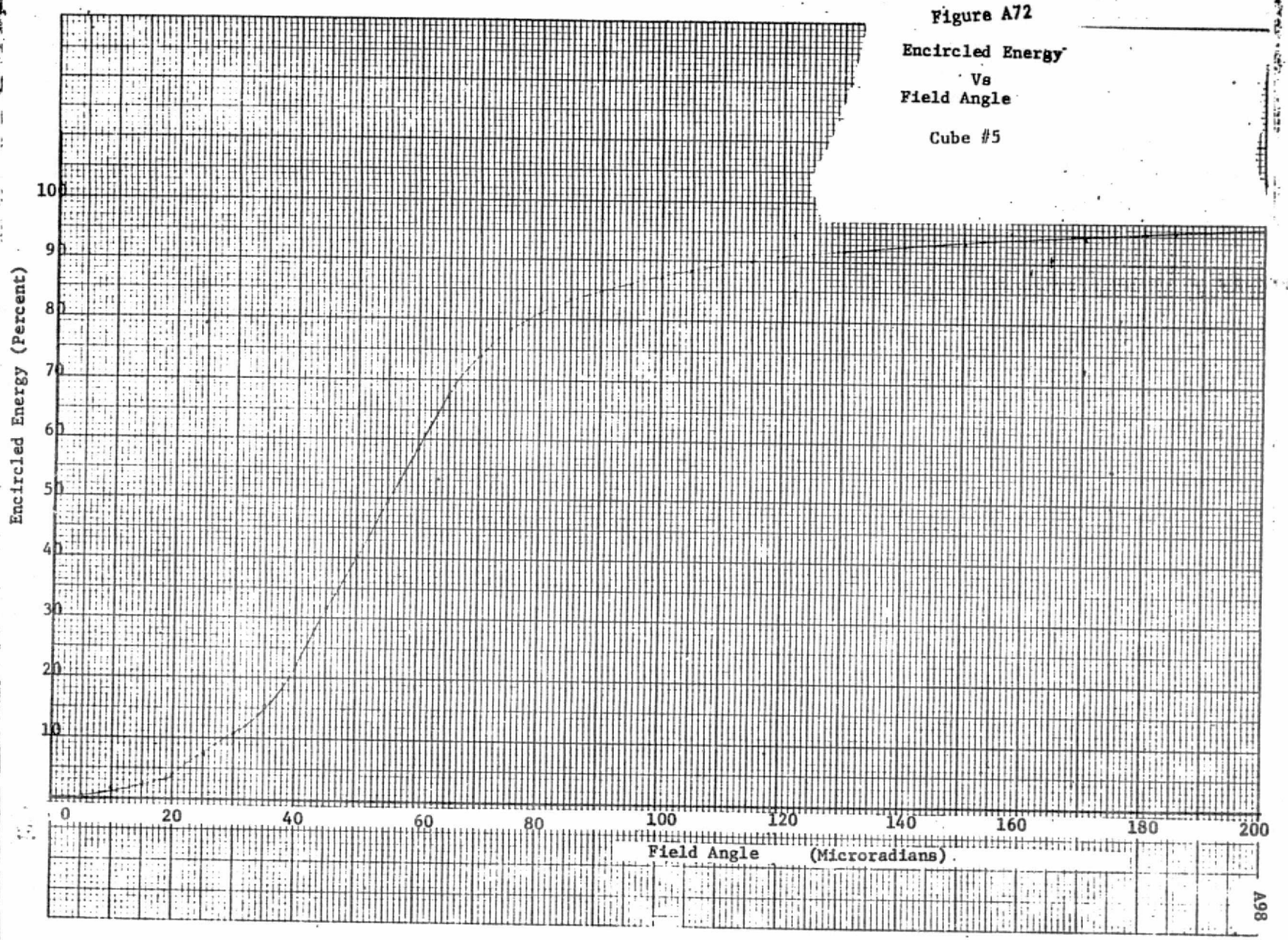


Table A26

ENCIRCLED ENERGY

Cube #5

CIRCLE RADIUS (MICRONS)	PERCENT ENERGY WITHIN CIRCLE CENTERED AT INDICATED COORDINATES								
CENTER (MICRONS): X=	-10.13	10.13	0.0	-10.13	0.0	10.13	0.0	-10.13	10.13
Y=	-10.13	-10.13	-10.13	0.0	0.0	0.0	10.13	10.13	10.13
2.00	0.0	0.0	0.1	0.0	0.1	0.0	0.1	0.0	0.0
4.00	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.3	0.3
6.00	0.1	0.1	0.3	0.2	0.8	0.2	0.4	0.3	0.3
8.00	0.4	0.5	0.7	0.5	0.8	0.5	0.8	0.8	0.8
10.00	0.7	0.7	0.9	0.7	1.3	0.7	1.1	1.2	1.1
12.00	1.7	1.8	1.5	1.3	1.4	1.3	1.8	2.3	2.1
14.00	1.7	1.8	2.0	2.0	1.9	2.1	2.7	2.3	2.1
16.00	2.9	3.1	2.6	2.7	2.2	2.8	3.3	3.5	3.3
18.00	3.5	3.7	3.3	3.5	3.6	3.6	4.2	4.1	3.9
20.00	4.5	4.8	4.2	4.4	3.6	4.4	5.0	5.1	4.9
22.00	5.0	5.3	5.4	5.5	5.6	5.5	6.0	5.8	5.5
24.00	6.4	6.9	6.2	6.1	6.6	6.2	6.7	7.3	6.9
26.00	7.1	7.7	7.7	7.5	8.4	7.5	7.9	8.2	7.7
28.00	9.2	10.0	9.9	9.2	9.0	9.3	10.1	10.5	9.9
30.00	10.6	11.5	11.3	10.7	10.8	10.8	11.4	12.0	11.4
32.00	13.7	14.6	13.4	12.4	12.0	12.5	13.7	15.2	14.5
34.00	14.4	15.3	15.4	14.7	13.6	14.9	15.9	15.9	15.3
36.00	17.9	18.7	17.7	16.8	15.9	17.0	18.6	19.4	18.7
38.00	19.7	20.5	19.8	19.3	19.3	19.6	20.9	21.3	20.7
40.00	22.8	23.5	22.3	21.7	21.2	22.0	23.8	24.3	23.9
42.00	24.4	25.0	25.5	25.3	26.1	25.5	27.0	25.9	25.6
44.00	27.9	28.4	27.7	27.3	28.7	27.4	29.3	29.5	29.3
46.00	30.6	30.9	31.3	31.7	33.8	31.7	32.8	32.3	32.1
48.00	34.1	34.3	35.2	35.4	35.2	35.3	36.7	35.8	35.7
50.00	37.3	37.4	38.1	38.6	40.0	38.5	39.4	39.0	38.8
52.00	41.4	41.5	41.8	42.4	42.6	42.3	43.1	43.0	42.8
54.00	43.7	43.7	45.2	46.2	46.9	46.0	46.5	45.4	45.0
56.00	48.0	48.0	49.6	50.3	49.9	50.2	50.9	49.5	49.1
58.00	51.2	51.2	52.3	53.0	54.6	52.9	53.8	52.6	52.2
60.00	54.6	54.6	55.9	56.8	58.1	56.6	57.4	55.9	55.6
62.00	57.0	56.9	59.2	60.3	62.2	60.1	60.6	58.1	58.0
64.00	61.0	60.8	61.7	62.9	65.5	62.7	63.3	61.9	61.9
66.00	63.3	63.1	65.2	66.5	69.2	66.3	66.5	64.1	64.2
68.00	66.5	66.2	67.9	68.8	70.9	68.7	68.8	67.2	67.4
70.00	68.5	68.2	70.7	71.5	73.8	71.4	71.3	69.0	69.3
72.00	71.4	71.2	72.8	73.6	75.8	73.5	73.2	71.8	72.1
74.00	73.0	72.7	75.3	75.7	77.6	75.7	75.4	73.2	73.5
76.00	75.6	75.4	77.3	77.5	78.8	77.5	77.2	75.6	75.8
78.00	77.2	77.0	78.5	78.7	80.1	78.7	78.3	77.1	77.2
80.00	78.9	78.7	80.0	80.0	81.0	80.1	79.9	78.7	78.9

Table A27

ENCIRCLED ENERGY

Cube #5

CIRCLE RADIUS (MICRONS)	PERCENT ENERGY WITHIN CIRCLE CENTERED AT INDICATED COORDINATES								
CENTER (MICRONS): X=	-10.13	10.13	0.0	-10.13	0.0	10.13	0.0	-10.13	10.13
Y=	-10.13	-10.13	-10.13	0.0	0.0	0.0	10.13	10.13	10.13
5.00	0.1	0.1	0.3	0.2	0.5	0.2	0.3	0.3	0.3
10.00	0.7	0.7	0.9	0.7	1.3	0.7	1.1	1.2	1.1
15.00	2.4	2.5	2.4	2.4	2.2	2.5	3.1	3.0	2.8
20.00	4.5	4.8	4.2	4.4	3.6	4.4	5.0	5.1	4.9
25.00	6.9	7.4	7.4	7.3	7.3	7.3	7.7	7.9	7.5
30.00	10.6	11.5	11.3	10.7	10.8	10.8	11.4	12.0	11.4
35.00	16.4	17.4	16.4	15.4	15.2	15.6	17.0	17.9	17.2
40.00	22.8	23.5	22.3	21.7	21.2	22.0	23.8	24.3	23.9
45.00	29.3	29.7	29.8	30.1	31.7	30.2	31.2	30.9	30.8
50.00	37.3	37.4	38.1	38.6	40.0	38.5	39.4	39.0	38.8
55.00	46.5	46.6	47.6	48.3	49.2	48.2	48.9	48.0	47.6
60.00	54.6	54.6	55.9	56.8	58.1	56.6	57.4	55.9	55.6
65.00	62.0	61.8	63.9	65.1	67.7	64.9	65.2	62.9	63.0
70.00	68.5	68.2	70.7	71.5	73.8	71.4	71.3	69.0	69.3
75.00	74.5	74.3	76.3	76.7	78.2	76.7	76.3	74.7	74.8
80.00	78.9	78.7	80.0	80.0	81.0	80.1	79.9	78.7	78.9
85.00	81.8	81.6	82.5	82.6	83.3	82.6	82.6	81.6	81.8
90.00	83.8	83.7	84.2	84.3	84.8	84.3	84.5	83.8	84.0
95.00	85.5	85.5	85.7	85.7	85.9	85.7	85.9	85.6	85.6
100.00	86.8	86.9	87.0	86.9	87.0	86.9	86.9	86.8	86.8
105.00	87.8	87.9	88.1	88.1	88.2	88.1	87.9	87.8	87.7
110.00	88.8	88.8	89.0	89.1	89.2	89.1	88.8	88.7	88.7
115.00	89.8	89.7	89.8	89.9	90.0	89.9	89.7	89.6	89.7
120.00	90.5	90.4	90.5	90.6	90.7	90.6	90.6	90.4	90.5
125.00	91.1	91.0	91.2	91.2	91.3	91.2	91.2	91.0	91.1
130.00	91.6	91.7	91.7	91.7	91.8	91.7	91.7	91.6	91.6
135.00	92.1	92.1	92.1	92.1	92.2	92.1	92.2	92.1	92.2
140.00	92.5	92.5	92.6	92.6	92.6	92.7	92.7	92.6	92.6
145.00	92.9	93.0	93.0	93.0	93.0	93.1	93.1	93.0	93.0
150.00	93.3	93.3	93.3	93.4	93.5	93.4	93.4	93.4	93.4
155.00	93.6	93.6	93.7	93.8	93.9	93.8	93.8	93.7	93.7
160.00	94.0	94.0	94.0	94.1	94.1	94.0	94.1	94.1	94.1
165.00	94.3	94.3	94.3	94.4	94.4	94.4	94.4	94.4	94.4
170.00	94.6	94.6	94.6	94.7	94.6	94.7	94.7	94.6	94.7
175.00	94.9	94.8	94.9	94.9	94.9	94.9	94.9	94.9	94.9
180.00	95.2	95.2	95.2	95.2	95.3	95.2	95.2	95.3	95.2
184.99	95.4	95.5	95.4	95.5	95.5	95.5	95.5	95.6	95.5
189.99	95.7	95.7	95.7	95.8	95.8	95.8	95.8	95.8	95.8
194.99	96.0	95.9	95.9	96.0	96.1	96.0	96.1	96.1	96.1
199.99	96.3	96.2	96.2	96.3	96.3	96.3	96.3	96.3	96.3

Figure A73

Wavefront Map - Q Polarization

Cube #6

MAP IN UNITS OF 0.01 WAVES

```
                                                35 35 31 23 17 20 26 32 36 38
                                          38 39 37 33 30 28 18 16 18 25 31 34 36 39 40 40
                                       38 38 37 32 30 26 22 16 13 17 21 27 31 34 37 38 40 42
                                    38 38 38 35 29 29 23 18 12  7 14 18 22 26 31 35 37 40 40 41
                                 34 35 35 35 32 29 23 20 11 11  4  5 10 17 24 27 29 34 36 36 38 40
                              31 31 31 29 28 23 19 16 13 12  4  0  1  5 12 18 21 22 27 29 30 32 34 34
                           23 28 26 28 24 21 18 15 10  7  3 -2 -4 -3  0  6 10 14 19 22 23 26 28 31 30 25
                        9 11 14 19 20 20 14 13 10  6  1 -2 -4 -8 -6 -3  0  4 10 14 16 18 22 23 26 18 16 10
                        2  2  7 -1 -1  5  6  5  3  0 -4 -9 -11 -16 -14 -6 -5  0  3  7  9 11 12 10  8  7  5  6
                        2 -3 -5 -11 -16 -6  0 -6 -2 -10 -12 -15 -21 -27 -26 -20 -10 -8 -3  0  0  1 -8 -10 -9  0  1  6
                     4  1 -1 -7 -13 -19 -20 -23 -12 -16 -15 -18 -22 -28 -34 -33 -28 -15 -13 -8 -12 -15 -16 -16 -14 -8 -3  2  5  8
                  10  6  1 -3 -6 -15 -25 -30 -36 -30 -25 -32 -30 -36 -41 -40 -37 -25 -22 -29 -27 -31 -31 -19 -13 -7  0  3  8 14
                  12  8  4  0 -3 -16 -25 -30 -38 -42 -47 -54 -50 -52 -52 -48 -42 -41 -46 -37 -44 -34 -28 -20 -12 -3  1  4 10 19
                  13  8  4 -1 -7 -13 -20 -29 -36 -43 -51 -60 -67 -68 -59 -59 -58 -60 -55 -47 -45 -36 -26 -20 -10 -4  0  5 10 20
                  13  9  6  0 -7 -13 -18 -27 -35 -40 -53 -58 -77 -76 -73 -75 -67 -73 -61 -50 -45 -34 -27 -17 -12 -7  0  7 12 15
                  19 12  7  0 -7 -12 -17 -27 -34 -45 -50 -61 -73 -67 -75 -73 -76 -77 -58 -53 -40 -35 -27 -18 -13 -7  0  6  9 13
                  20 10  5  0 -4 -10 -20 -26 -36 -45 -47 -55 -60 -58 -59 -59 -68 -67 -60 -51 -43 -36 -29 -20 -13 -7 -1  4  8 13
                  19 10  4  1 -3 -12 -20 -28 -34 -44 -37 -46 -41 -42 -48 -52 -52 -50 -54 -47 -42 -38 -30 -25 -16 -3  0  4  8 12
                  14  8  3  0 -7 -13 -19 -31 -31 -27 -29 -22 -25 -37 -40 -41 -36 -30 -32 -25 -30 -36 -30 -25 -15 -6 -3  1  6 10
                   8  5  2 -3 -6 -14 -16 -16 -15 -12  -8 -13 -15 -28 -33 -34 -28 -22 -18 -15 -16 -12 -23 -20 -19 -13 -7 -1  1  4
                     6  1  0 -9 -10 -8  1  0  0 -3 -8 -10 -20 -26 -27 -21 -15 -12 -10 -2 -6  0 -6 -16 -11 -5 -3  2
                     6  5  7  8 10 12 11  9  7  3  0 -5 -6 -14 -16 -11 -9 -4  0  3  5  6  5 -1 -1  7  2  2
                  10 16 18 26 23 22 18 16 14 10  4  0 -3 -6 -8 -4 -2  1  6 10 13 14 20 20 19 14 11  9
                        25 30 31 28 26 23 22 19 14 10  6  0 -3 -4 -2  3  7 10 15 18 21 24 28 26 28 23
                           34 34 32 30 29 27 22 21 18 12  5  1  0  4 12 13 16 19 23 28 29 31 31 31
                              40 38 36 36 34 29 27 24 17 10  5  4 11 11 20 23 29 32 35 35 35 34
                                 41 40 40 37 35 31 26 22 18 14  7 12 18 23 29 29 35 38 38 38
                                    42 40 38 37 34 31 27 21 17 13 16 22 26 30 32 37 38 38
                                       40 40 39 36 34 31 25 18 16 18 28 30 33 37 39 38
                                          38 35 32 26 20 17 23 31 35 35
```

Figure A74

Wavefront Plot – Q Polarization

Cube #6

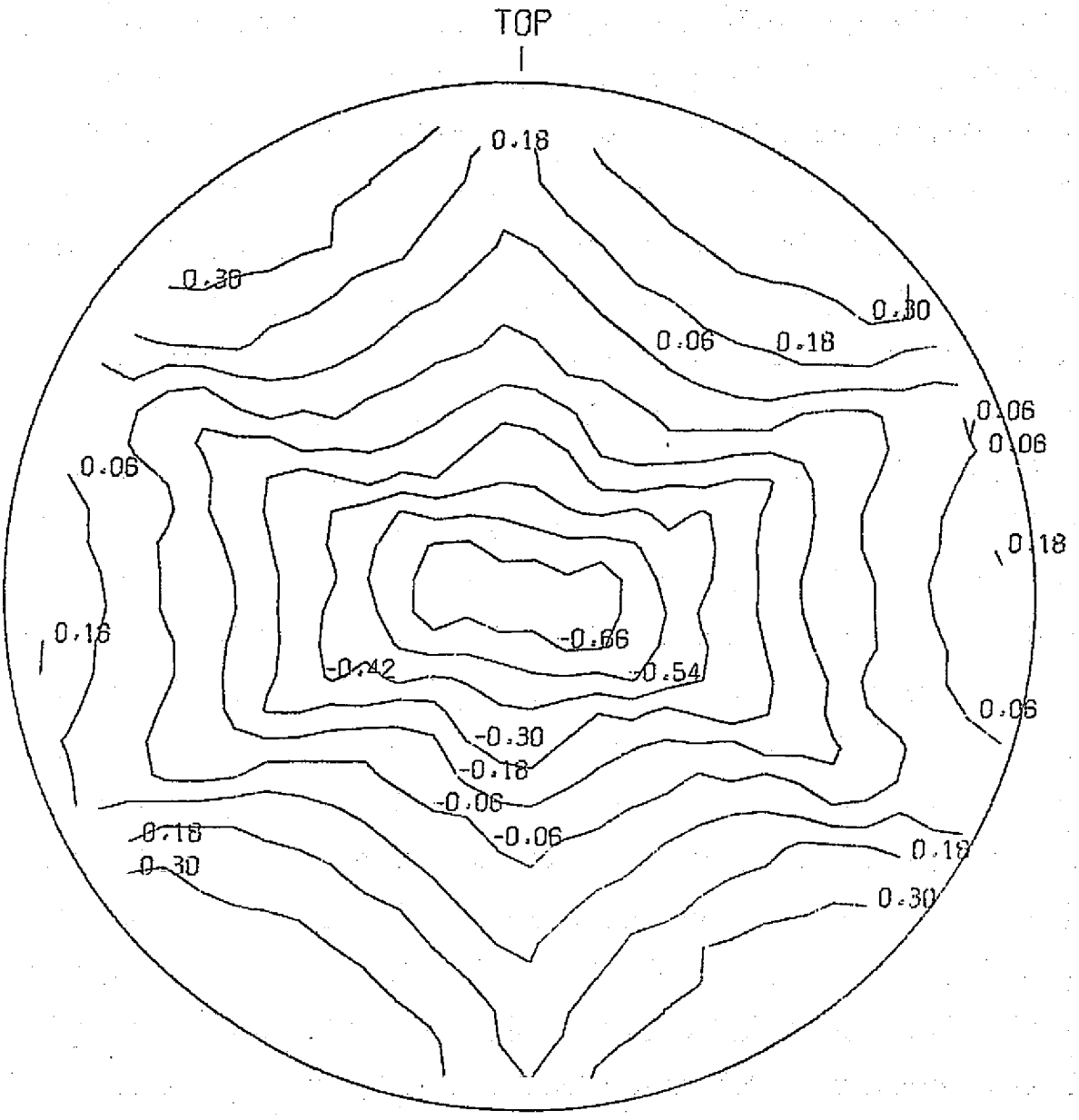


Figure A75

Wavefront Map – P Polarization

Cube #6

MAP IN UNITS OF 0.01 WAVES

										94	94	89	82	76	29	35	40	44	47										
							97	98	96	91	89	86	75	75	26	33	40	42	44	48	49	48							
						97	57	95	91	88	84	81	75	71	26	29	36	39	42	46	46	49	50						
					96	97	96	94	87	87	81	76	70	65	22	26	31	34	39	43	45	48	48	49					
				92	93	94	94	90	88	82	78	69	69	63	14	18	26	33	35	38	42	44	45	47	48				
			90	90	89	88	86	81	78	74	72	70	62	59	10	14	20	26	29	31	36	38	38	40	43	43			
		81	87	84	86	83	79	77	74	68	65	61	55	53	4	8	14	19	23	28	31	31	35	36	39	39	33		
	25	69	72	77	78	79	72	71	68	65	60	55	53	50	1	5	9	13	18	22	25	26	30	32	34	26	25	-23	
	18	18	23	56	57	63	65	64	62	58	53	49	46	42	-6	2	2	7	12	15	18	19	21	18	17	-26	-28	-27	
	18	12	10	4	41	51	57	52	55	48	46	42	37	30	-17	-11	-1	0	4	7	9	9	0	-1	-43	-34	-32	-27	
20	17	14	8	2	-3	-4	35	45	42	42	39	35	29	23	-25	-20	-6	-5	0	-3	-6	-7	-50	-48	-42	-37	-31	-28	-25
26	22	17	12	9	0	-9	-14	-20	27	32	25	28	22	17	-31	-29	-16	-13	-20	-18	-65	-65	-53	-47	-41	-34	-30	-25	-13
28	24	20	15	12	0	-9	-14	-22	-26	-31	4	8	5	5	-40	-34	-32	-37	-71	-78	-68	-62	-54	-46	-37	-32	-29	-23	-14
29	24	20	14	8	2	-4	-13	-20	-27	-35	-44	-8	-9	0	-51	-49	-51	-89	-81	-79	-70	-60	-54	-44	-38	-34	-28	-23	-13
29	25	22	16	8	2	-2	-11	-19	-24	-37	-42	-61	-60	-15	-66	-101	-107	-95	-84	-79	-68	-61	-51	-46	-41	-34	-26	-21	-13
31	28	23	15	8	3	-1	-11	-18	-29	-34	-45	-57	-51	-54	-3	-110	-111	-92	-87	-74	-69	-61	-52	-47	-41	-33	-27	-24	-20
36	26	21	15	11	5	-4	-10	-20	-29	-31	-39	-39	-38	-39	10	1	2	-94	-85	-77	-70	-63	-54	-47	-41	-35	-29	-25	-23
35	26	20	17	12	3	-4	-12	-18	-28	-21	-26	-20	-22	-28	17	17	20	15	-81	-76	-72	-64	-59	-50	-37	-34	-29	-25	-21
30	24	19	15	8	2	-3	-15	-15	-6	-8	-1	-5	-17	-19	29	34	40	37	44	39	-70	-69	-59	-49	-40	-37	-32	-27	-23
24	21	18	12	7	1	0	3	4	7	11	6	4	-8	-13	35	41	47	51	54	54	57	47	-54	-53	-47	-41	-35	-32	-29
	22	17	15	6	10	12	21	20	19	16	11	9	0	-6	42	49	54	57	59	67	63	69	63	53	-45	-39	-37	-31	
	22	21	23	28	30	32	31	29	27	23	19	14	13	5	53	58	60	65	70	73	76	76	75	68	68	-26	-31	-31	
	26	36	38	46	43	42	38	36	34	30	25	20	16	13	61	65	67	72	76	80	83	84	90	90	89	84	81	-24	
		45	50	51	48	46	43	42	39	34	30	26	20	16	65	67	73	77	80	86	88	91	94	98	96	99	93		
			54	54	52	50	49	47	43	41	38	32	26	21	70	74	82	84	86	90	93	98	99	101	101	101			
				60	58	56	56	54	49	47	44	37	30	25	74	81	81	90	93	99	102	105	105	105	104				
					61	60	60	57	55	51	46	42	38	34	77	82	88	93	99	99	105	108	109	108					
						62	60	58	57	54	51	47	41	37	83	87	93	96	100	102	107	109	109						
							60	60	59	56	54	52	45	38	86	88	98	101	103	108	110	108							
										58	56	52	46	40	87	93	101	105	105										

Figure A76

Wavefront Plot - P Polarization

Cube #6

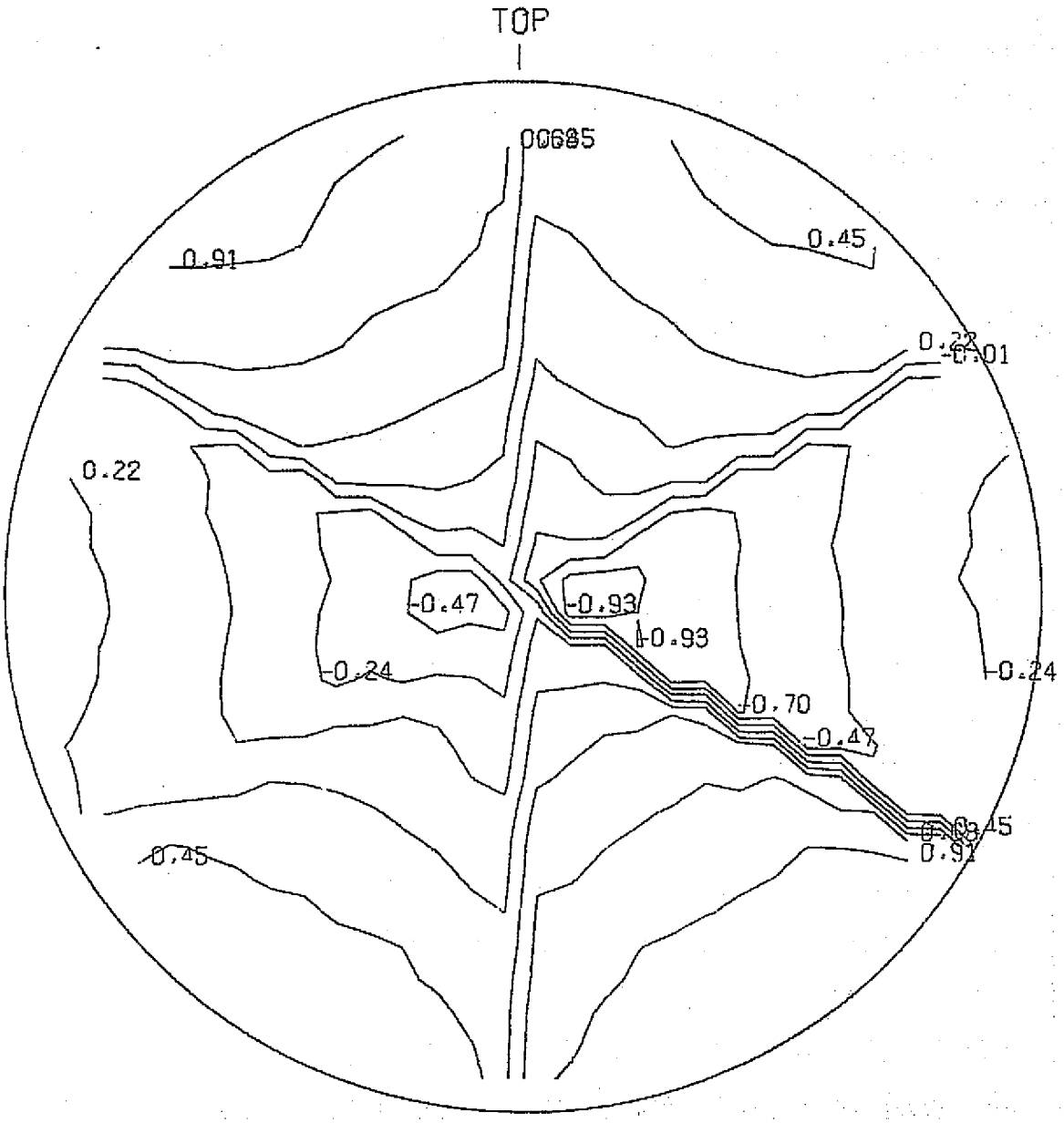


Figure A77

PRINTER MAP OF POINT SPREAD FUNCTION
Cube #6
(ONE SPACE REPRESENTS 8.04 MICRONS)
NORMALIZED SO LARGEST VALUE = 0.0237 = 100
TOTAL ENERGY = 0.2461000D+01
MAP REPRESENTS 0.2324824D+01 OR 94.4666 PERCENT OF TOTAL ENERGY

0	0	0	0	0	0	0	0	0	0	1	2	3	2	1	1	0	0	0	1	1	3	3	2	1	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	1	0	0	0	0	1	1	1	2	1	1	1	1	1	1	2	2	2	1	1	0	0	0	0	0	0	0	0	0	0
0	0	0	0	1	0	0	1	0	0	1	1	1	2	1	1	0	0	0	1	1	2	1	1	1	0	0	1	0	0	1	0	0	0	0
0	0	0	0	0	0	0	0	0	0	1	1	2	3	3	2	1	0	1	2	3	2	2	1	1	1	1	1	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	1	2	3	4	4	3	3	3	4	4	3	2	1	0	0	1	1	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	1	1	1	2	2	3	3	4	7	6	3	2	2	1	1	1	1	0	1	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	1	1	1	2	4	4	5	5	4	5	5	4	4	3	3	1	1	1	1	1	1	0	1	0	0	0	0
1	0	0	0	1	1	0	0	0	1	2	3	2	2	5	10	10	8	10	9	5	2	2	3	2	1	1	0	0	1	1	0	0	0	0
0	0	0	0	1	0	0	0	1	2	3	1	0	1	3	9	15	16	16	10	3	1	0	1	3	2	1	0	0	0	1	0	0	0	0
0	0	0	0	0	0	0	0	2	3	1	2	2	2	7	14	17	19	19	13	6	1	1	2	2	2	2	0	0	0	0	0	0	0	0
0	0	1	1	0	0	0	1	2	2	2	3	2	8	25	27	25	30	27	28	25	10	3	4	3	2	2	2	0	0	0	0	0	0	0
1	1	1	0	0	1	3	3	2	2	4	8	14	26	34	33	54	75	55	35	35	29	18	10	5	2	2	3	3	1	0	0	1	1	0
1	1	1	0	1	2	3	3	1	4	9	15	23	30	36	49	70	79	69	52	40	34	25	16	9	4	1	2	4	3	1	0	1	1	1
1	1	1	1	2	3	2	2	4	8	12	12	22	42	60	70	58	47	63	76	71	53	24	11	12	8	5	3	3	4	3	1	1	2	2
1	1	1	1	1	2	2	3	5	7	9	11	27	48	61	63	73	94	86	69	66	57	28	10	10	7	5	4	2	2	2	1	1	2	1
0	1	0	0	1	2	2	2	2	6	11	19	27	29	58	52	43	74	56	52	56	34	28	20	13	6	2	2	2	2	0	0	1	1	0
1	1	1	1	1	2	2	2	1	10	17	32	43	32	67	43	11	45	13	38	66	37	48	37	20	11	1	2	2	2	1	1	1	1	1
1	1	0	0	1	2	1	1	1	13	17	33	55	24	28	14	25	84	25	13	29	25	55	33	17	13	1	1	1	2	1	0	0	1	1
1	1	0	1	2	3	1	1	3	15	17	17	31	8	27	45	34	45	36	53	34	9	28	14	14	14	3	1	1	3	2	1	0	1	1
1	1	0	1	2	3	1	2	4	10	10	4	19	31	62	100	92	74	80	93	66	32	21	3	7	8	3	2	1	3	2	1	0	1	1
1	1	1	1	1	1	1	3	3	1	3	6	37	77	82	78	92	94	75	67	74	70	38	8	3	1	1	2	1	1	0	1	1	1	1
1	1	2	2	2	2	2	3	2	3	11	21	43	83	100	79	56	47	53	72	85	67	39	23	15	6	2	2	2	1	1	2	2	1	1
1	1	1	1	2	2	2	2	2	5	16	26	31	41	60	75	78	79	81	72	50	31	24	23	17	7	2	2	2	1	1	1	1	1	1
0	0	0	0	0	1	2	4	4	4	7	12	17	19	21	33	58	75	61	35	23	19	13	8	5	4	4	4	2	0	0	0	0	0	0
0	0	0	0	0	0	1	4	5	4	2	2	3	12	21	23	26	30	26	25	25	13	3	1	1	3	5	4	1	0	0	0	0	0	0
0	0	0	0	0	0	0	1	4	4	2	2	1	2	10	16	18	18	16	15	10	2	2	1	1	3	4	1	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	2	4	3	1	1	1	2	7	14	16	12	6	1	1	1	0	2	3	1	0	0	0	1	0	0	0	0
0	0	0	0	1	1	1	0	0	1	2	2	1	1	4	8	9	9	9	7	3	1	1	2	2	1	0	0	0	1	1	0	0	0	0
0	0	0	0	1	2	2	1	0	0	0	1	2	3	5	6	6	5	6	7	5	3	3	2	1	1	0	0	1	2	1	0	0	0	0
0	0	0	0	1	1	2	1	0	0	1	1	1	3	3	3	5	7	5	3	3	3	2	1	1	1	0	0	1	1	0	0	0	0	0
0	0	0	0	0	0	0	1	1	0	0	1	1	1	2	1	2	3	2	2	2	2	1	1	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	1	2	1	1	1	1	0	1	2	2	2	1	1	0	0	0	0	0	0	0	0	0	0	0
0	0	0	1	1	0	0	0	0	0	1	2	2	2	1	1	0	0	0	1	1	2	2	2	1	0	0	1	0	0	0	0	0	0	0
0	0	0	0	1	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	0	0	0	0	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0

ID
ID

ORIGINAL PAGE IS
OF POOR QUALITY

22584

Figure A78

Point Spread Function

Cube #6

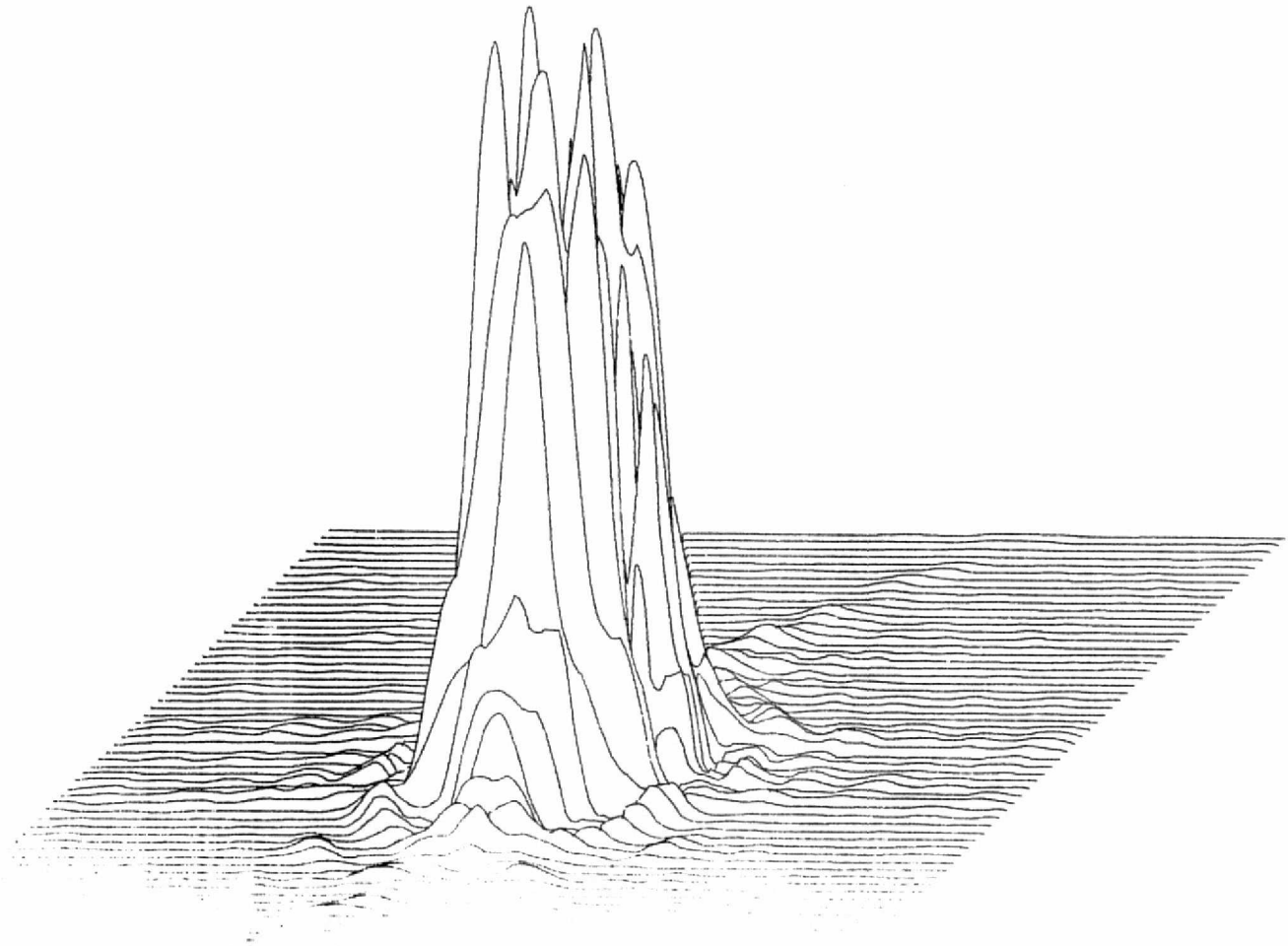
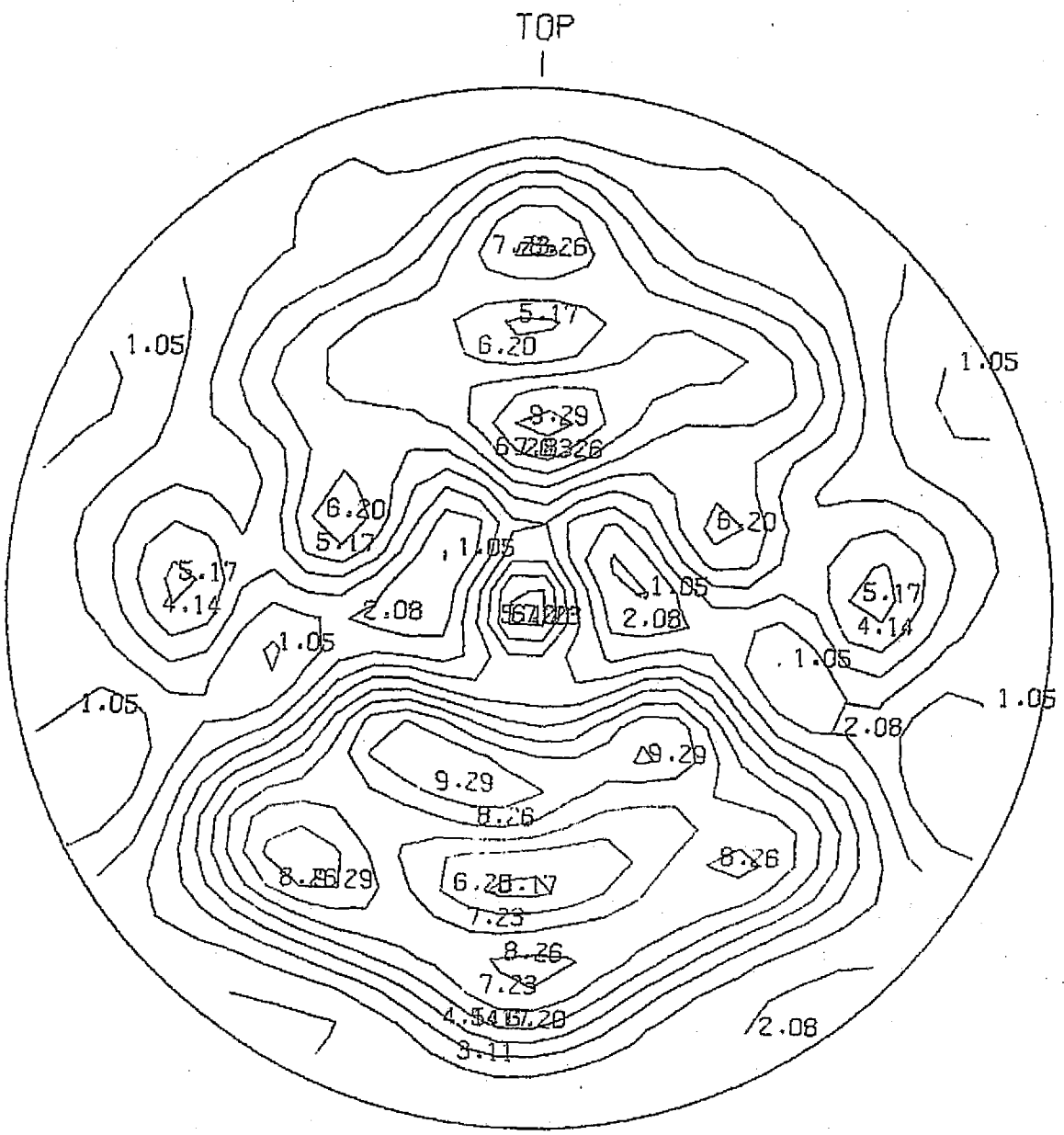


Figure A79

Intensity Distribution - Central 129 Microradians

Cube #6



46 1472

Figure A80

Encircled Energy
Vs
Field Angle

Cube #6

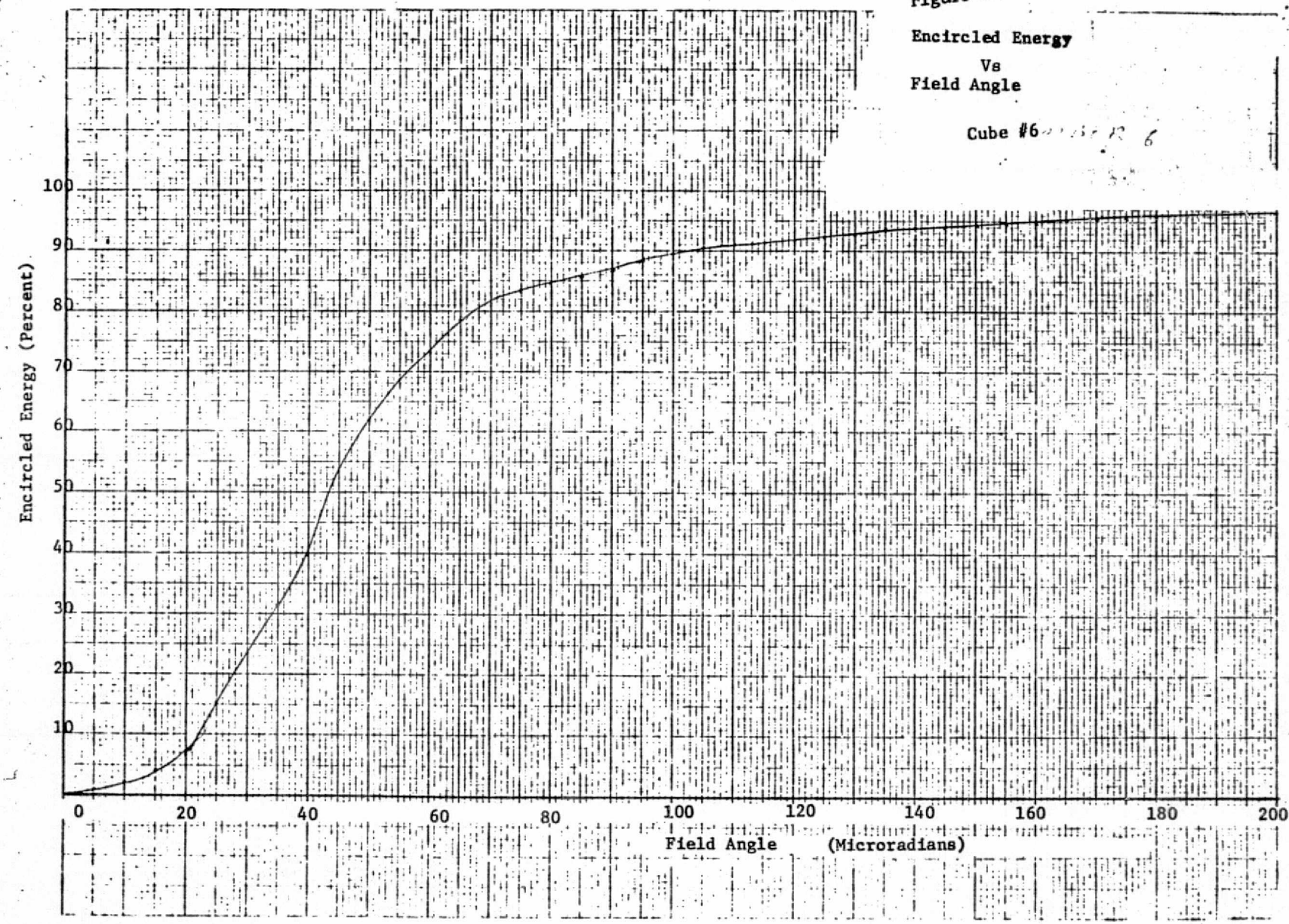


Table A28

ENCIRCLED ENERGY

Cube #6

CIRCLE RADIUS (MICRONS)	PERCENT ENERGY WITHIN CIRCLE CENTERED AT INDICATED COORDINATES								
CENTER (MICRONS): X=	-10.13	10.13	0.0	-10.13	0.0	10.13	0.0	-10.13	10.13
Y=	-10.13	-10.13	-10.13	0.0	0.0	0.0	10.13	10.13	10.13
2.00	0.0	0.0	0.1	0.0	0.2	0.0	0.1	0.0	0.0
4.00	0.2	0.2	0.2	0.1	0.2	0.1	0.2	0.5	0.5
6.00	0.2	0.2	0.7	0.3	1.3	0.3	0.9	0.5	0.5
8.00	0.8	0.9	1.4	0.8	1.3	0.8	1.6	1.6	1.6
10.00	1.3	1.4	1.8	1.1	2.2	1.1	2.3	2.2	2.2
12.00	3.3	3.4	3.1	2.2	2.4	2.2	3.8	4.5	4.4
14.00	3.3	3.4	4.0	3.6	3.3	3.7	5.5	4.5	4.4
16.00	5.9	6.1	5.5	4.8	4.0	4.9	7.1	7.2	7.0
18.00	7.1	7.3	6.8	6.6	6.9	6.7	8.8	8.5	8.3
20.00	9.3	9.5	8.9	8.4	6.9	8.5	10.8	10.6	10.4
22.00	10.3	10.6	10.9	11.0	11.3	11.0	12.7	11.9	11.7
24.00	13.1	13.4	12.6	12.3	13.4	12.3	14.3	14.7	14.5
26.00	14.4	14.8	15.5	15.4	17.8	15.5	16.6	16.2	16.0
28.00	17.9	18.4	19.3	18.9	19.1	19.0	20.5	19.8	19.6
30.00	20.3	20.9	22.0	22.0	23.4	22.1	22.7	22.5	22.2
32.00	25.4	26.0	25.6	24.9	25.7	25.0	26.5	27.4	27.2
34.00	26.5	27.0	28.9	29.0	28.6	29.2	30.0	28.6	28.3
36.00	31.9	32.4	32.9	32.3	32.4	32.5	34.5	33.9	33.6
38.00	34.5	35.0	36.0	36.1	37.4	36.2	37.7	36.5	36.3
40.00	38.8	39.2	39.7	39.5	39.9	39.6	42.0	40.7	40.6
42.00	41.1	41.4	43.5	44.1	46.2	44.3	45.8	43.0	42.9
44.00	45.5	45.6	46.2	46.3	49.5	46.4	48.9	47.1	47.2
46.00	48.4	48.4	50.1	51.4	55.6	51.4	52.5	50.1	50.2
48.00	52.1	52.0	54.2	55.0	57.0	55.0	56.3	53.6	53.9
50.00	55.1	55.0	56.9	58.2	62.0	58.2	58.4	56.6	56.9
52.00	58.9	58.7	60.7	61.7	64.0	61.7	61.9	60.0	60.2
54.00	61.0	60.8	63.7	64.9	67.2	64.9	64.2	62.3	62.3
56.00	64.9	64.7	67.5	68.2	69.0	68.2	67.7	65.4	65.6
58.00	67.5	67.3	69.3	70.1	71.8	70.1	69.4	67.8	67.9
60.00	70.2	70.0	72.1	72.5	73.6	72.5	72.0	70.2	70.3
62.00	72.0	71.8	73.7	74.4	75.7	74.5	73.7	71.9	72.0
64.00	74.6	74.5	75.4	75.8	77.3	75.8	75.6	74.4	74.5
66.00	75.9	75.9	77.1	77.6	79.3	77.6	77.3	75.9	75.9
68.00	77.7	77.6	78.6	78.7	80.0	78.8	78.7	77.7	77.8
70.00	78.7	78.6	79.8	80.1	81.4	80.1	80.0	78.7	78.8
72.00	80.2	80.2	81.0	81.0	82.2	81.0	81.1	80.2	80.3
74.00	80.9	80.9	82.1	82.2	83.1	82.1	82.0	81.0	81.0
76.00	82.2	82.2	83.1	83.0	83.5	82.9	82.9	82.2	82.3
78.00	83.0	83.0	83.6	83.7	84.2	83.7	83.4	83.0	83.0
80.00	83.9	83.9	84.4	84.3	84.5	84.3	84.2	83.9	83.9

Table A29

ENCIRCLED ENERGY

Cube #6

CIRCLE RADIUS (MICRONS)	PERCENT ENERGY WITHIN CIRCLE CENTERED AT INDICATED COORDINATES								
	CENTER (MICRONS):								
	X= -10.13	10.13	0.0	-10.13	0.0	10.13	0.0	-10.13	10.13
	Y= -10.13	-10.13	-10.13	0.0	0.0	0.0	10.13	10.13	10.13
5.00	0.2	0.2	0.6	0.3	0.8	0.3	0.7	0.5	0.5
10.00	1.3	1.4	1.8	1.1	2.2	1.1	2.3	2.2	2.2
15.00	4.9	5.0	5.1	4.2	4.0	4.3	6.6	6.1	6.0
20.00	9.3	9.5	8.9	8.4	6.9	8.5	10.8	10.6	10.4
25.00	14.0	14.3	14.8	15.1	15.2	15.1	16.2	15.7	15.5
30.00	20.3	20.9	22.0	22.0	23.4	22.1	22.7	22.5	22.2
35.00	29.8	30.3	30.9	30.1	31.4	30.2	31.9	31.6	31.4
40.00	38.8	39.2	39.7	39.5	39.9	39.6	42.0	40.7	40.6
45.00	47.0	47.1	48.5	49.7	53.2	49.7	50.9	48.8	48.9
50.00	55.1	55.0	56.9	58.2	62.0	58.2	58.4	56.6	56.9
55.00	63.5	63.3	65.9	66.7	68.6	66.6	66.3	64.1	64.3
60.00	70.2	70.0	72.1	72.5	73.6	72.5	72.0	70.2	70.3
65.00	75.2	75.1	76.5	76.9	78.5	76.9	76.6	75.1	75.2
70.00	78.7	78.6	79.8	80.1	81.4	80.1	80.0	78.7	78.8
75.00	81.7	81.7	82.6	82.6	83.3	82.6	82.6	81.7	81.8
80.00	83.9	83.9	84.4	84.3	84.5	84.3	84.2	83.9	83.9
85.00	85.5	85.4	85.7	85.8	85.8	85.8	85.7	85.4	85.4
90.00	86.7	86.7	86.8	87.0	86.9	87.0	86.9	86.7	86.8
95.00	87.9	87.9	87.9	88.1	88.2	88.1	88.1	88.0	88.0
100.00	88.9	88.9	89.0	89.1	89.4	89.1	89.1	88.9	88.9
105.00	89.8	89.7	90.0	90.0	90.3	90.0	89.9	89.7	89.7
110.00	90.6	90.6	90.8	90.7	91.0	90.8	90.6	90.5	90.4
115.00	91.3	91.3	91.4	91.3	91.4	91.3	91.2	91.2	91.2
120.00	91.8	91.9	91.8	91.8	91.8	91.8	91.8	91.8	91.8
125.00	92.3	92.3	92.3	92.3	92.3	92.3	92.3	92.3	92.3
130.00	92.7	92.7	92.7	92.7	92.8	92.8	92.7	92.7	92.7
135.00	93.1	93.1	93.1	93.2	93.3	93.2	93.2	93.2	93.2
140.00	93.5	93.5	93.5	93.6	93.6	93.6	93.7	93.6	93.6
145.00	93.8	93.8	93.9	94.0	94.0	94.0	94.1	94.0	94.0
150.00	94.2	94.2	94.2	94.3	94.3	94.3	94.4	94.3	94.3
155.00	94.5	94.5	94.6	94.6	94.6	94.6	94.7	94.6	94.6
160.00	94.8	94.8	94.8	94.9	94.8	94.9	94.9	94.9	94.9
165.00	95.1	95.1	95.1	95.2	95.2	95.1	95.2	95.2	95.2
170.00	95.4	95.4	95.4	95.4	95.4	95.4	95.5	95.5	95.5
175.00	95.6	95.6	95.6	95.7	95.7	95.7	95.8	95.7	95.7
180.00	95.9	95.9	95.9	96.0	96.0	96.0	96.0	96.0	96.0
184.99	96.1	96.1	96.1	96.2	96.2	96.2	96.2	96.2	96.2
189.99	96.4	96.3	96.4	96.4	96.4	96.4	96.5	96.4	96.4
194.99	96.6	96.6	96.6	96.6	96.7	96.6	96.6	96.6	96.6
199.99	96.8	96.8	96.8	96.8	96.8	96.8	96.8	96.9	96.8

Figure A81

Wavefront Map - Q Polarization

Cube #1RW

MAP IN UNITS OF -0.01 WAVES

```
                                    -51 -54 -53 -57 -58 -59 -57 -53 -47 -46
                                -46 -48 -49 -48 -51 -51 -55 -57 -59 -56 -49 -46 -45 -40 -40 -40
                            -42 -42 -42 -43 -43 -45 -48 -49 -52 -52 -49 -45 -43 -40 -38 -38 -39 -37
                        -43 -41 -40 -40 -41 -42 -43 -46 -49 -53 -51 -47 -43 -41 -39 -38 -38 -37 -37 -39
                    -43 -41 -40 -38 -39 -40 -42 -42 -45 -49 -50 -54 -49 -45 -41 -40 -39 -37 -37 -37 -38 -38
                -44 -41 -37 -37 -37 -38 -39 -40 -42 -43 -47 -53 -53 -51 -46 -43 -41 -40 -38 -38 -36 -38 -39 -42
            -45 -42 -39 -38 -37 -37 -37 -39 -41 -42 -44 -46 -57 -55 -50 -47 -43 -42 -40 -39 -39 -39 -39 -39 -43 -48
        32 -41 -40 -39 -37 -37 -38 -38 -40 -43 -45 -46 -49 -55 -53 -51 -48 -45 -43 -43 -40 -40 -40 -41 -43 -47 -42 22
        32  32  40 -34 -37 -38 -38 -40 -41 -44 -46 -48 -52 -54 -53 -53 -50 -48 -44 -44 -43 -43 -42 -42 -36  27  31  29
        22  33  35 -37 -33 -36 -40 -42 -44 -45 -46 -50 -53 -55 -58 -54 -51 -50 -47 -46 -47 -45 -43 -42 -36 -35 -32 -30
    31  33  36  38  37  36  28 -49 -47 -46 -48 -49 -53 -55 -61 -65 -57 -54 -53 -51 -50 -44 -50  27  31  34  36  38  35  33
    35  36  37  38  38  37  32  32  26 -44 -47 -51 -55 -57 -65 -65 -61 -57 -54 -55 -47  27  29  30  33  35  37  38  38  35
    36  39 -39  35 -39 -38 -33 -28 -30 -28 -25 -56 -58 -61 -66 -64 -62 -61 -60  19  23  25  28  30  35  37  39  40  39  38
    40  41  40  35  39  37  34  30  27  25  20  12 -63 -66 -69 -68 -68 -65   7  20  23  26  29  33  36  37  39  40  40  39
    41  41  40  40  39  36  34  31  27  24  19  16  12  -1 -66 -70   0   7  16  19  24  27  30  33  35  39  40  41  41  40
    40  41  41  40 -39  35 -33 -30  27  24 -19  16   7   0 -70 -66  -1  12  16 -19 -24 -27 -31 -34 -36 -39  40  40  41  41
    39  40  40  39  37  36  33  29  26  23  20   7 -65 -68 -68 -69 -66 -63  12  20  25  27  30  34  37  39  39  40  41  40
    38  39  40  39  37  35  30  28  25  23  19 -60 -61 -62 -64 -66 -61 -58 -56  25  28  30  28  33  38  39  39  39  39  36
    35 -38  38  37  35  33  30  29  27 -47 -55 -54 -57 -61 -65 -65 -57 -55 -51 -47 -44 -26 -32 -22 -37 -38 -38 -37 -36 -35
    33  35  38  36  34  31  27 -50 -44 -50 -51 -53 -54 -57 -65 -61 -55 -53 -49 -48 -46 -47 -49  28  36  37  36  36  33  31
        30  32  35  36 -42 -43 -45 -47 -46 -47 -50 -51 -54 -58 -55 -53 -50 -46 -45 -44 -42 -40 -36 -33  37  35  33  32
        29  31  27 -36 -42 -42 -43 -42 -44 -44 -48 -50 -53 -53 -54 -52 -48 -46 -44 -41 -40 -38 -38 -37 -34 -40 -32 -32
        22 -42 -47 -43 -41 -40 -40 -40 -43 -43 -45 -48 -51 -53 -55 -49 -46 -45 -43 -40 -38 -38 -37 -37 -39 -40 -41  32
            -48 -43 -35 -35 -35 -39 -39 -40 -42 -43 -47 -50 -55 -57 -46 -44 -42 -41 -39 -37 -37 -37 -38 -39 -42 -45
                -42 -39 -38 -36 -38 -38 -40 -41 -43 -46 -51 -53 -53 -47 -43 -42 -40 -39 -38 -37 -37 -37 -41 -44
                    -38 -38 -37 -37 -37 -39 -40 -41 -45 -49 -54 -50 -49 -45 -42 -42 -40 -39 -38 -40 -41 -43
                        -39 -37 -37 -38 -38 -39 -41 -43 -47 -51 -53 -49 -46 -43 -42 -41 -40 -40 -41 -43
                            -37 -39 -38 -38 -40 -43 -45 -49 -52 -52 -49 -48 -45 -43 -43 -42 -42 -42
                                -40 -40 -40 -45 -46 -49 -56 -59 -57 -55 -51 -51 -48 -49 -48 -46
                                    -46 -47 -53 -57 -59 -58 -57 -53 -54 -51
```

Figure A82

Wavefront Plot - Q Polarization

Cube #1RW

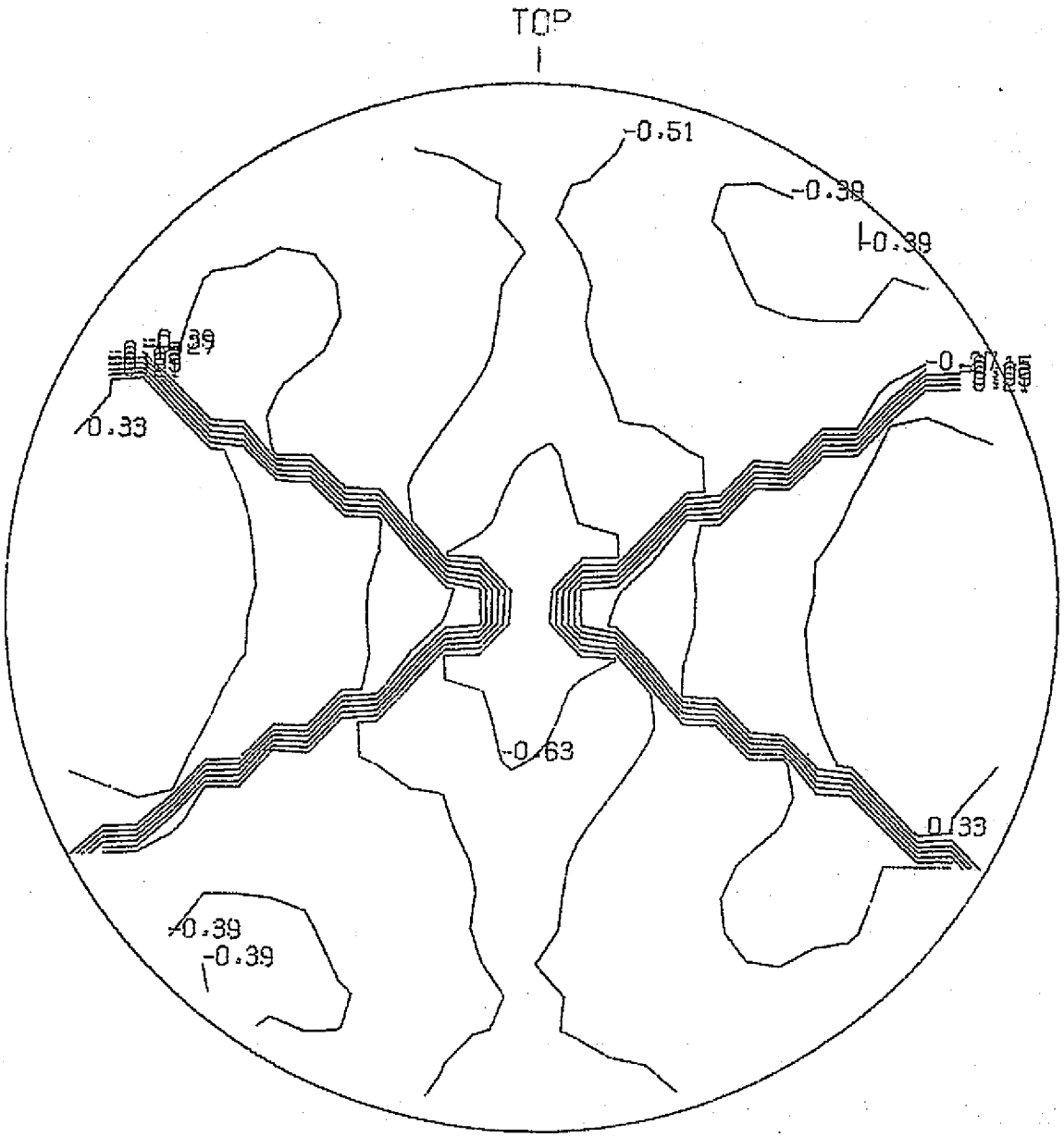


Figure A83

Wavefront Map - P Polarization

Cube #1RW

MAP IN UNITS OF 0.01 WAVES


```
                                                  6   3   4   0   0 -51 -49 -44 -39 -38
                                          11  10   9  10   7   6   3   0 -50 -48 -41 -37 -37 -32 -31 -31
                                      15  16  15  14  14  13  10   8   6 -43 -41 -36 -34 -31 -30 -30 -31 -29
                                  14  17  17  17  17  16  15  11   8   4 -42 -38 -35 -32 -30 -30 -29 -29 -28 -30
                              15  16  17  15  19  17  16  15  13   9   8 -46 -41 -36 -33 -31 -30 -29 -28 -29 -30 -30
                          14  16  20  20  20  20  19  18  15  14  10   4 -44 -43 -37 -34 -33 -31 -30 -29 -28 -30 -30 -34
                      13  15  19  20  21  21  20  19  17  15  13  11   1 -46 -42 -38 -35 -33 -31 -30 -30 -30 -30 -31 -34 -40
                  48  16  18  19  20  21  20  20  18  15  13  11   8   3 -44 -42 -40 -37 -35 -34 -32 -32 -32 -33 -34 -39 -34 -11
                  48  48  56  23  21  20  19  18  17  14  12  10   6   3 -45 -44 -41 -39 -35 -35 -34 -34 -33 -34 -28  -6  -2  -4
                  48  49 -51 -53 -24 -21 -18 -16 -14  12 -11  -7  -5   2 -50 -46 -42 -42 -39 -37 -39 -36 -35 -34   2   1  -1  -3
              47  49  52  52  53  52  44   8  10  11  10   8   5   2  -2 -56 -48 -45 -45 -43 -41 -35 -42  -6  -2   0   2   4   1   0
              51  52  53  54  54  53  48  48  42  14  11   6   2   1  -6 -56 -52 -49 -46 -46 -38  -6  -4  -3   0   1   3   4   4   1
              52  55  55  55  55  54  49  44  46  44 -41   2   0  -2  -7 -56 -54 -53 -52 -14 -10  -8  -5  -3   1   3   5   6   5   4
              56  57  56  55  55  53  50  46  43  41  36  28  -4  -7 -10 -59 -59 -57 -26 -13 -10  -7  -4   0   2   3   5   6   6   5
              57  57  56  56  55  52  50  47  43  40  35  32  28  14  -8 -62 -33 -26 -17 -14  -9  -6  -3   0   1   5   6   7   7   6
              58  57  57  56  55 -51 -49 -46 -43 -40 -35 -32  23  16 -50  -3 -35 -21 -17 -14  -9  -6  -2   0   2   5   6   6   7   7
              55  56  56  55  53  52  49  45  42  39  36  23 -45 -48 -48   0   4   6 -21 -13  -8  -6  -3   0   3   5   5   6   7   6
              54  55  56  55  53  51  46  44  41  39  35 -40 -41 -42 -44   4   8  11  14  -8  -5  -3  -5   0   4   5   5   5   5   2
              51  54  54  53  51  49  46  45  43 -26 -35 -34 -37 -40 -45   5  13  14  18  22  25  -7  -1  -1   3   4   4   3   2   1
              49  51  54  52  50  47  43 -30 -24 -25 -31 -33 -33 -36 -45   8  14  17  20  22  23  22  20  -5   2   3   2   2   0  -2
                  46  48  51  52 -22 -23 -25 -27 -26 -27 -30 -30 -34 -38  14  17  19  23  24  26  27  30  33  36   3   1   0  -1
                  45  47  43 -16 -22 -22 -22 -23 -24 -24 -28 -29 -33 -33  15  18  22  23  25  28  29  31  31  32  35   6  -1  -1
                  38 -22 -27 -23 -21 -20 -20 -20 -23 -23 -25 -28 -31 -33  15  20  23  25  27  29  31  32  32  32  31  29  28  -1
                     -28 -23 -19 -18 -19 -19 -19 -20 -22 -23 -27 -30 -34  13  23  25  27  29  30  32  33  32  31  30  27  24
                         -22 -19 -18 -16 -18 -18 -19 -21 -23 -26 -31 -33  16  22  26  27  29  30  32  32  32  32  28  25
                             -18 -18 -17 -16 -17 -19 -20 -21 -25 -29 -34  20  20  24  27  27  29  31  31  29  28  26
                                 -19 -17 -17 -18 -18 -19 -21 -23 -27 -31  16  20  23  26  28  29  29  29  28  26
                                     -17 -19 -18 -18 -20 -23 -25 -29 -31  17  20  21  24  26  26  27  27  27
                                         -20 -20 -20 -25 -26 -29 -36 -39  12  14  18  18  21  21  22  23
                                                 -26 -27 -32 -37 -39  12  12  16  15  18
```

Figure A84

Wavefront Plot - P Polarization

Cube #1RW

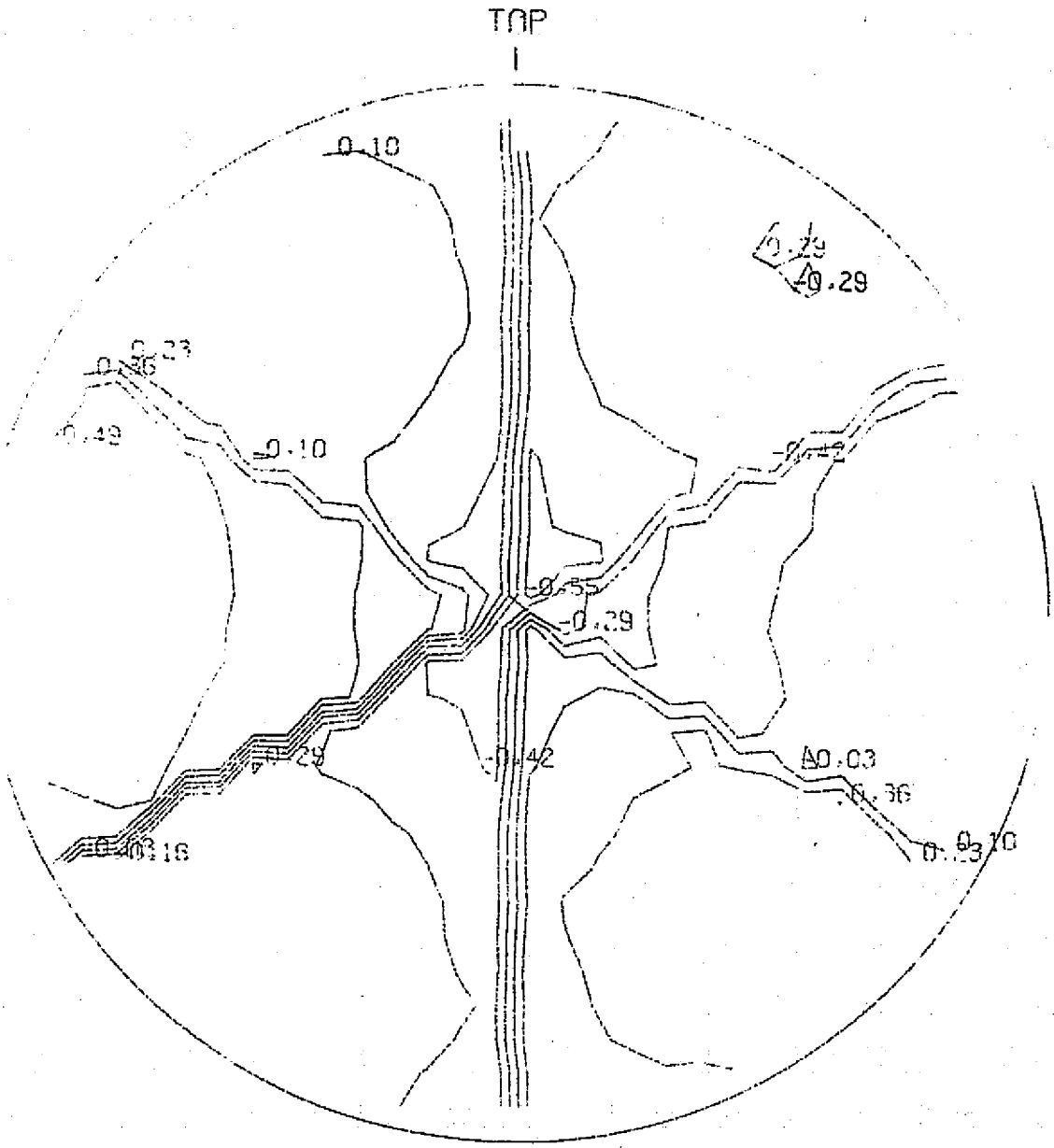
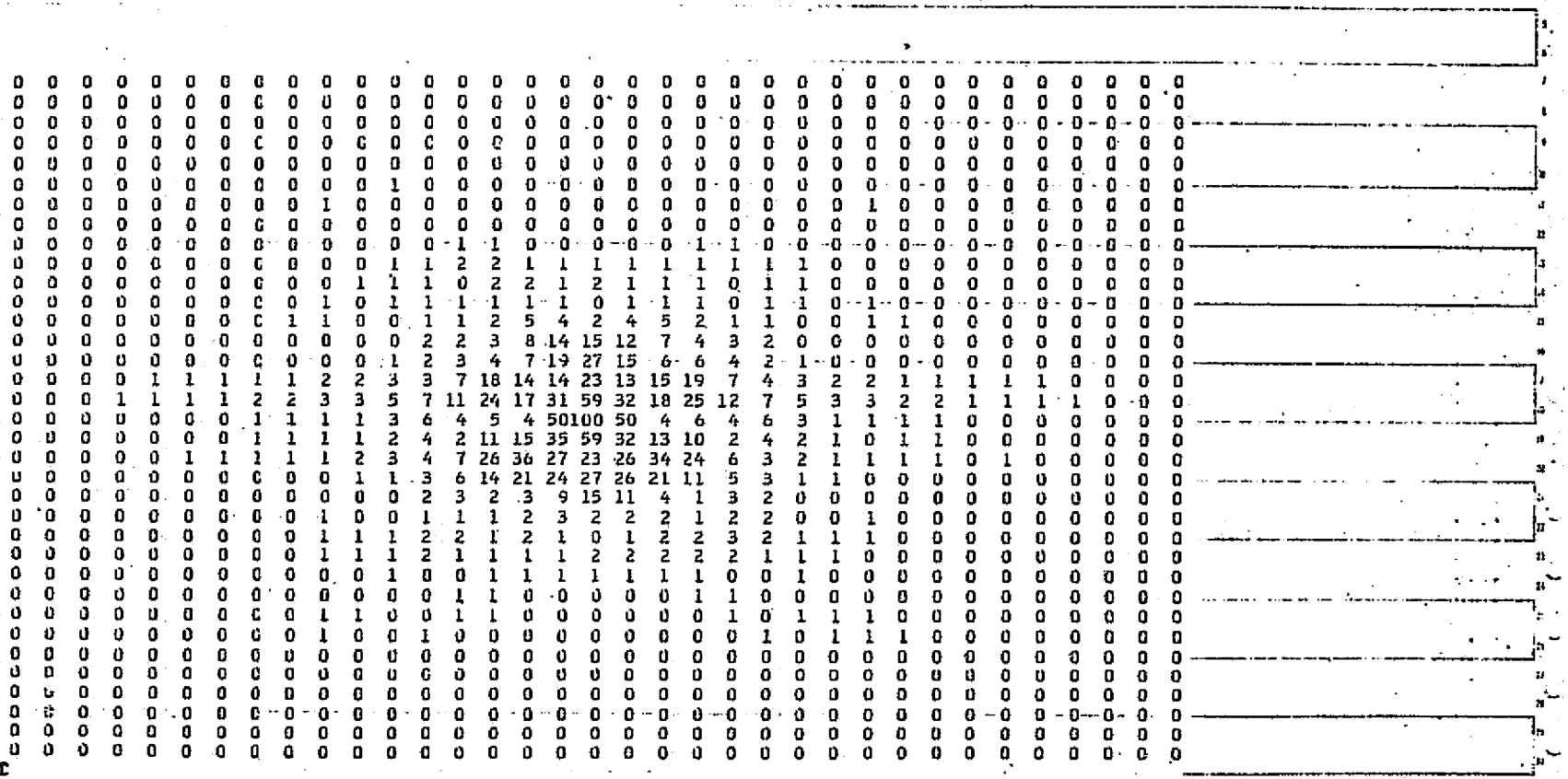


Figure A85

PRINTER MAP OF POINT SPREAD FUNCTION
Cube #1RW
(ONE SPACE REPRESENTS 8.04 MICRONS)
NORMALIZED SO LARGEST VALUE = 0.1278 = 100
TOTAL ENERGY = 0.2461000D+01
MAP REPRESENTS 0.2302223D+01 OR 93.5483 PERCENT OF TOTAL ENERGY



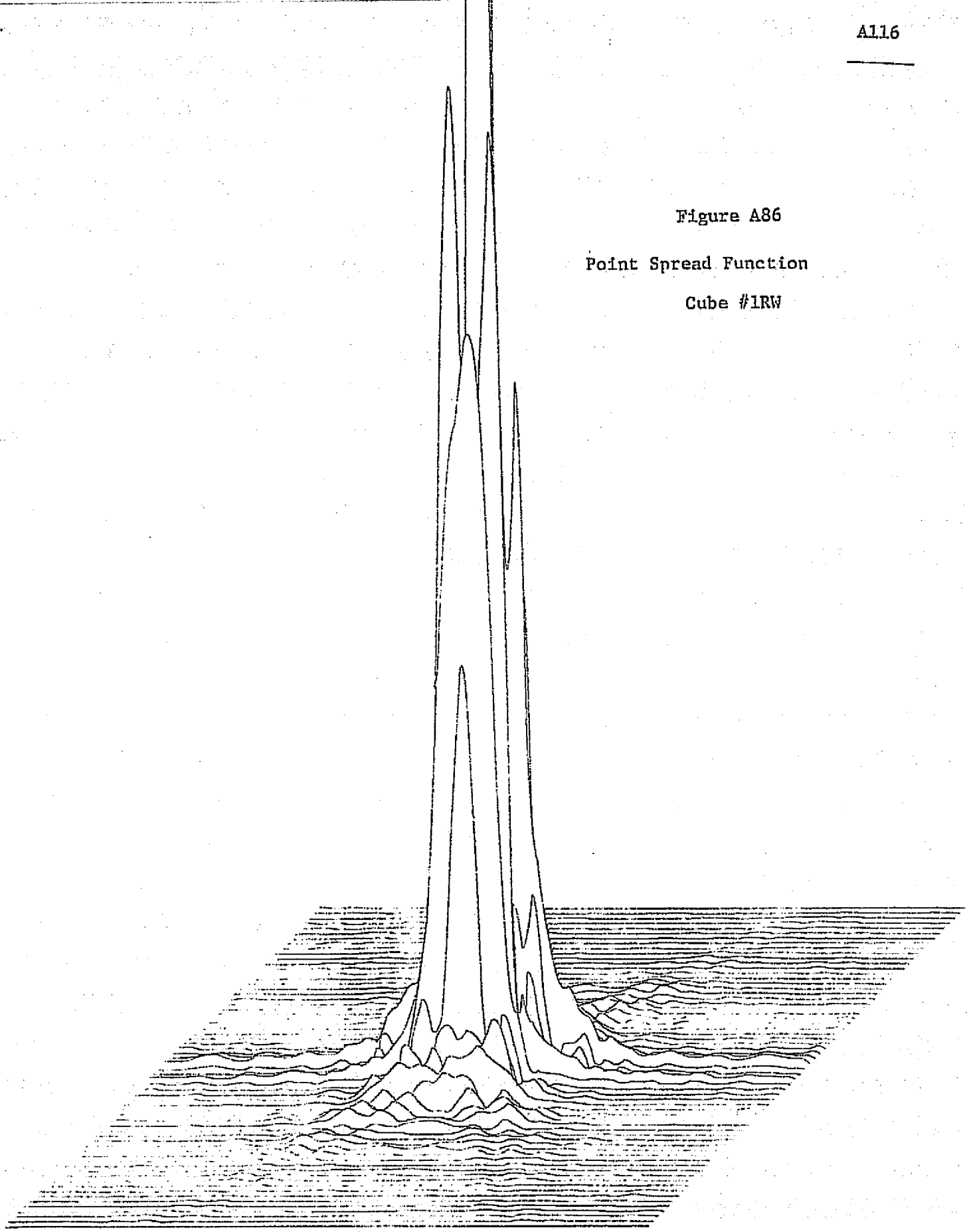


Figure A86

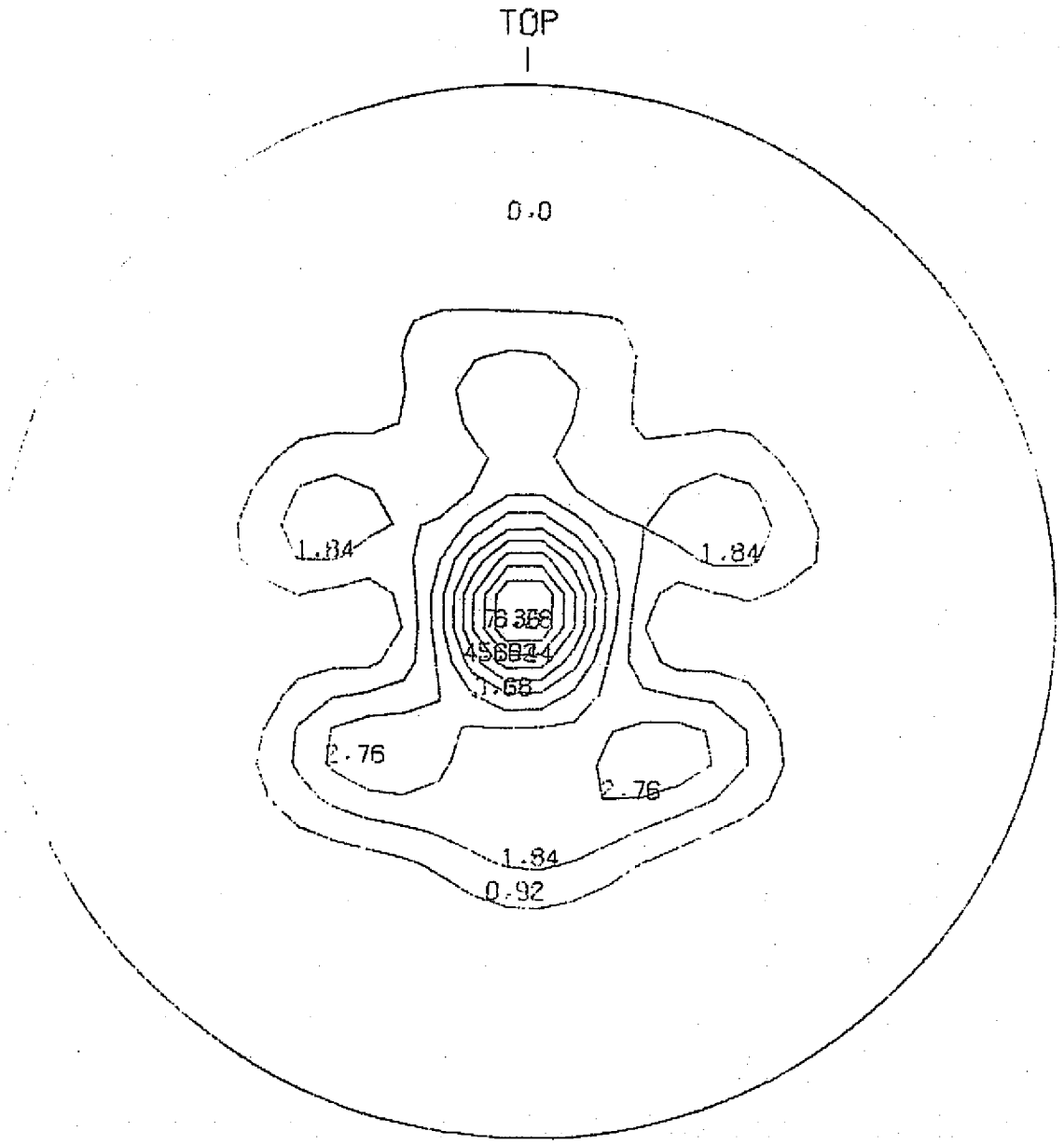
Point Spread Function

Cube #1RW

Figure A87

Intensity Distribution - Central 129 Microradians.

Cube #1RW



ORIGINAL PAGE IS
OF POOR QUALITY

Figure A88

Encircled Energy
Vs
Field Angle

Cube #1RW

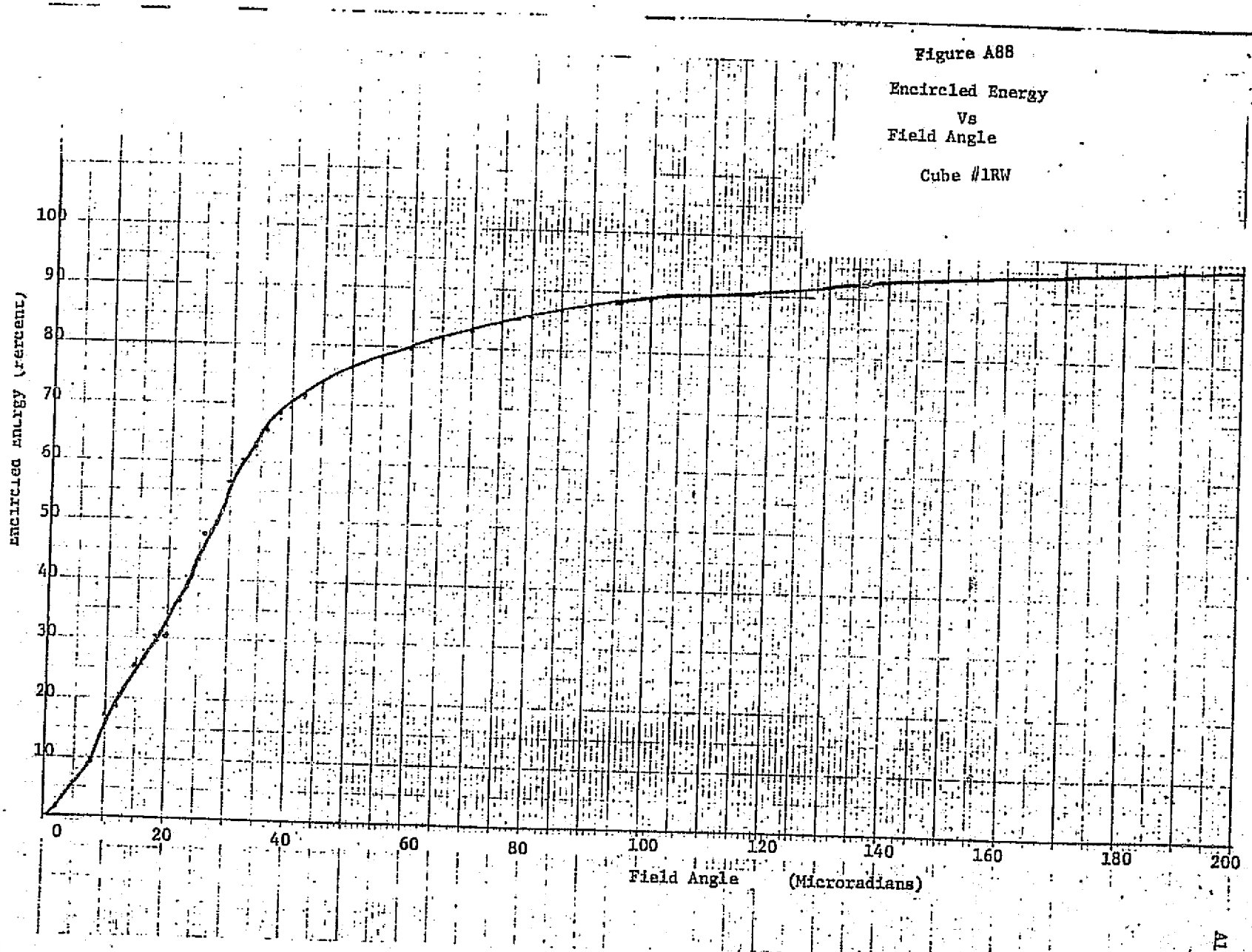


Table A30

ENCIRCLED ENERGY

Cube #1RW

CIRCLE RADIUS (MICRONS)	PERCENT ENERGY WITHIN CIRCLE CENTERED AT INDICATED COORDINATES								
	CENTER (MICRONS):								
	X= -10.13	10.13	0.0	-10.13	0.0	10.13	0.0	-10.13	10.13
	Y= -10.13	-10.13	-10.13	0.0	0.0	0.0	10.13	10.13	10.13
2.00	0.0	0.0	0.5	0.3	1.3	0.3	0.5	0.0	0.0
4.00	1.1	1.2	1.2	0.9	1.3	0.9	1.2	1.5	1.4
6.00	1.1	1.2	3.6	2.6	9.5	2.6	3.7	1.5	1.4
8.00	3.7	3.8	7.1	5.8	9.5	5.8	7.3	4.7	4.5
10.00	5.2	5.4	8.7	7.2	17.1	7.2	9.2	6.5	6.2
12.00	11.6	11.7	14.1	12.6	18.8	12.6	15.1	13.6	13.3
14.00	11.6	11.7	17.6	17.2	22.9	17.1	19.6	13.6	13.3
16.00	19.3	19.2	22.4	22.0	25.2	21.9	25.0	21.8	21.6
18.00	22.4	22.4	25.5	26.1	30.4	25.9	28.9	25.4	25.2
20.00	27.4	27.3	30.9	31.9	30.4	31.8	35.2	30.6	30.5
22.00	30.6	30.5	33.9	36.2	36.8	36.1	38.7	34.2	34.1
24.00	36.1	36.0	37.2	39.0	40.4	38.9	42.1	39.7	39.6
26.00	38.3	38.4	41.1	43.6	47.5	43.5	45.7	42.4	42.3
28.00	43.0	43.1	45.2	48.0	49.5	47.9	50.0	46.5	46.3
30.00	46.1	46.3	49.0	51.7	56.2	51.6	52.4	50.0	49.7
32.00	51.6	51.8	52.5	54.9	59.1	54.8	55.5	54.4	54.1
34.00	52.5	52.7	56.5	58.9	62.7	58.9	58.3	55.3	55.1
36.00	58.0	58.2	60.4	62.0	65.5	62.0	61.4	59.6	59.3
38.00	60.4	60.6	63.6	65.2	68.1	65.2	63.2	61.3	61.2
40.00	64.0	64.0	66.8	67.7	69.2	67.7	66.1	64.3	64.2
42.00	66.2	66.1	69.4	69.9	71.5	70.0	68.2	65.9	66.0
44.00	69.5	69.3	71.0	71.3	72.5	71.3	70.2	68.7	68.8
46.00	71.0	70.8	72.8	72.6	74.2	72.6	72.1	70.2	70.4
48.00	73.0	72.7	74.2	73.9	74.7	73.9	73.9	72.3	72.7
50.00	74.2	73.9	75.2	74.5	76.1	74.5	75.1	73.8	74.1
52.00	75.5	75.2	76.1	75.7	76.7	75.8	76.4	75.2	75.6
54.00	76.1	75.8	77.1	76.5	77.6	76.5	77.5	76.1	76.5
56.00	77.3	77.1	77.9	77.6	78.1	77.7	78.6	77.4	77.7
58.00	77.9	77.8	78.6	78.3	79.1	78.4	79.2	78.4	78.5
60.00	78.9	78.8	79.2	79.2	79.7	79.3	79.9	79.2	79.4
62.00	79.4	79.4	80.0	80.0	80.5	80.1	80.5	79.8	79.9
64.00	80.4	80.4	80.5	80.7	81.1	80.8	80.9	80.7	80.7
66.00	80.9	81.0	81.3	81.5	81.9	81.6	81.5	81.2	81.2
68.00	81.7	81.9	81.8	82.2	82.3	82.2	81.9	81.9	81.9
70.00	82.2	82.3	82.5	82.8	82.9	82.8	82.5	82.3	82.3
72.00	83.0	83.1	83.1	83.4	83.4	83.4	83.0	83.0	83.0
74.00	83.3	83.4	83.8	83.9	84.0	83.9	83.6	83.4	83.3
76.00	84.1	84.2	84.3	84.5	84.4	84.4	84.1	84.0	83.9
78.00	84.5	84.6	84.8	84.8	85.0	84.7	84.6	84.5	84.4
80.00	85.0	85.1	85.2	85.3	85.4	85.2	85.1	85.0	84.9

Table A31

ENCIRCLED ENERGY

Cube #1RW

CIRCLE RADIUS (MICRONS)	PERCENT ENERGY WITHIN CIRCLE CENTERED AT INDICATED COORDINATES								
CENTER (MICRONS):									
X=	-10.13	10.13	0.0	-10.13	0.0	10.13	0.0	-10.13	10.13
Y=	-10.13	-10.13	-10.13	0.0	0.0	0.0	10.13	10.13	10.13
5.00	1.1	1.2	3.3	2.6	5.7	2.6	3.4	1.5	1.4
10.00	5.2	5.4	8.7	7.2	17.1	7.2	9.2	6.5	6.2
15.00	16.3	16.2	21.6	20.5	25.2	20.4	23.7	18.5	18.3
20.00	27.4	27.3	30.9	31.9	30.4	31.8	35.2	30.6	30.5
25.00	37.6	37.6	40.1	42.9	43.1	42.7	45.1	41.4	41.4
30.00	46.1	46.3	49.0	51.7	56.2	51.6	52.4	50.0	49.7
35.00	56.2	56.5	58.5	60.2	64.8	60.1	59.5	57.9	57.5
40.00	64.0	64.0	66.8	67.7	69.2	67.7	66.1	64.3	64.2
45.00	70.3	70.1	72.2	72.0	73.5	72.0	71.3	69.7	69.9
50.00	74.2	73.9	75.2	74.5	76.1	74.5	75.1	73.8	74.1
55.00	76.9	76.7	77.5	77.2	78.0	77.3	78.0	76.9	77.2
60.00	78.9	78.8	79.2	79.2	79.7	79.3	79.9	79.2	79.4
65.00	80.6	80.7	81.0	81.2	81.6	81.2	81.2	80.9	80.9
70.00	82.2	82.3	82.5	82.8	82.9	82.8	82.5	82.3	82.3
75.00	83.8	83.9	84.0	84.2	84.2	84.2	83.9	83.7	83.6
80.00	85.0	85.1	85.2	85.3	85.4	85.2	85.1	85.0	84.9
85.00	86.0	86.0	86.4	86.2	86.6	86.2	86.4	86.0	86.0
90.00	86.9	86.8	87.2	87.0	87.3	87.0	87.3	87.0	87.0
95.00	87.8	87.8	87.8	87.8	88.0	87.9	87.9	87.9	87.9
100.00	88.5	88.4	88.4	88.6	88.6	88.6	88.6	88.5	88.5
105.00	89.0	89.0	89.1	89.2	89.2	89.2	89.2	89.1	89.1
110.00	89.6	89.6	89.7	89.8	89.8	89.8	89.7	89.7	89.7
115.00	90.2	90.3	90.3	90.2	90.4	90.2	90.3	90.2	90.2
120.00	90.7	90.7	90.8	90.7	90.9	90.7	90.8	90.7	90.7
125.00	91.1	91.1	91.3	91.2	91.2	91.2	91.3	91.2	91.1
130.00	91.5	91.5	91.6	91.6	91.6	91.6	91.6	91.6	91.5
135.00	91.9	91.9	91.9	91.9	92.0	91.9	91.9	91.9	91.9
140.00	92.3	92.3	92.3	92.4	92.3	92.4	92.3	92.3	92.3
145.00	92.6	92.7	92.7	92.7	92.6	92.7	92.7	92.7	92.6
150.00	93.0	93.0	93.0	93.0	93.1	93.0	93.0	93.0	93.0
155.00	93.3	93.3	93.4	93.3	93.5	93.3	93.4	93.3	93.3
160.00	93.6	93.7	93.6	93.7	93.7	93.7	93.7	93.7	93.7
165.00	93.9	93.9	94.0	94.0	94.0	94.0	94.0	94.0	94.0
170.00	94.2	94.2	94.2	94.3	94.3	94.3	94.2	94.2	94.2
175.00	94.5	94.5	94.5	94.5	94.4	94.5	94.5	94.5	94.5
180.00	94.8	94.8	94.8	94.8	94.8	94.8	94.8	94.8	94.8
184.99	95.1	95.0	95.0	95.0	95.0	95.0	95.0	95.0	95.0
189.99	95.3	95.3	95.4	95.3	95.4	95.3	95.4	95.3	95.3
194.99	95.5	95.5	95.6	95.5	95.6	95.5	95.6	95.5	95.5
199.99	95.8	95.8	95.8	95.8	95.8	95.9	95.8	95.9	95.8

Figure A89

Wavefront Map - Q Polarization

Cube #2RW

MAP IN UNITS OF 0.01 WAVES

										-43	-40	-43	-47	-54	-50	-49	-45	-41	-41										
							-33	-33	-33	-37	-38	-39	-45	-49	-48	-46	-41	-39	-39	-37	-37	-37							
						-33	-31	-32	-32	-33	-36	-38	-41	-49	-42	-41	-38	-36	-34	-34	-35	-33	-36						
					-35	-32	-32	-32	-33	-34	-36	-39	-41	-44	-40	-39	-38	-35	-33	-32	-32	-33	-35	-37					
				-31	-34	-32	-32	-33	-34	-35	-37	-39	-42	-48	-46	-43	-40	-37	-34	-34	-34	-33	-35	-37	-39				
			-46	-38	-36	-34	-33	-35	-35	-36	-39	-41	-44	-49	-52	-44	-41	-39	-36	-34	-35	-34	-34	-37	-42	-44			
		-48	-47	-42	-37	-37	-36	-37	-36	-40	-41	-43	-47	-55	-50	-45	-43	-41	-39	-36	-36	-37	-35	-37	-42	-47	-52		
	21	-47	-46	-45	-40	-40	-41	-38	-40	-44	-44	-47	-50	-48	-48	-48	-47	-43	-42	-39	-38	-39	-40	-40	-44	-48	-42	24	
	25	25	25	-47	-41	-43	-45	-44	-44	-47	-47	-49	-53	-53	-51	-51	-49	-46	-44	-42	-41	-42	-43	-42	-44	27	31	27	
	27	28	28	27	-47	-44	-48	-47	-48	-49	-50	-53	-57	-60	-56	-56	-52	-51	-48	-46	-47	-48	-49	-42	30	34	30	31	
30	30	32	31	29	25	30	-48	-51	-51	-51	-55	-59	-61	-65	-63	-59	-57	-55	-52	-50	-43	-44	26	32	33	36	35	36	33
36	38	39	35	32	30	26	21	17	-52	-58	-62	-66	-65	-72	-69	-63	-62	-60	-58	-50	26	29	30	33	36	37	39	37	37
38	40	40	38	36	31	27	23	19	16	10	-69	-70	-73	-77	-77	-70	-68	-65	14	19	24	27	31	35	37	40	41	42	40
41	42	41	39	37	34	25	25	19	15	9	6	-72	-73	-75	-78	-73	-70	5	13	18	23	28	32	35	38	40	42	43	42
43	43	41	35	38	35	30	26	23	16	10	7	0	-2	-73	-76	-6	0	6	11	19	24	28	31	35	39	40	42	44	44
44	44	42	40	35	35	31	28	24	15	11	6	0	-6	-76	-73	-2	0	7	10	16	23	26	30	35	38	39	41	43	43
42	43	42	40	38	35	32	28	23	18	13	5	-70	-73	-78	-75	-73	-72	6	9	15	19	25	29	34	37	39	41	42	41
40	42	41	40	37	35	31	27	24	19	14	-65	-68	-70	-77	-77	-73	-70	-69	10	16	19	23	27	31	36	38	40	40	38
37	37	39	37	36	33	30	29	26	-50	-58	-60	-62	-63	-69	-72	-65	-66	-62	-58	-52	-17	21	26	30	32	35	39	38	36
32	36	35	36	32	32	26	-44	-43	-50	-52	-55	-57	-59	-63	-65	-61	-59	-55	-51	-51	-51	-48	30	25	29	31	32	30	30
	31	30	34	30	-42	-49	-48	-47	-46	-48	-51	-52	-56	-56	-60	-57	-53	-50	-49	-48	-47	-48	-44	-47	27	28	28	27	
	27	31	27	-44	-42	-43	-42	-41	-42	-44	-46	-49	-51	-51	-53	-53	-49	-47	-47	-44	-44	-45	-43	-41	-47	25	25	25	
	24	-42	-48	-44	-40	-40	-39	-38	-39	-42	-43	-47	-48	-48	-48	-50	-47	-44	-44	-40	-38	-41	-40	-40	-45	-46	-47	21	
		-52	-47	-42	-37	-35	-37	-36	-36	-39	-41	-43	-45	-50	-55	-47	-43	-41	-40	-38	-37	-36	-37	-37	-42	-47	-48		
			-44	-42	-37	-34	-34	-35	-34	-36	-39	-41	-44	-52	-49	-44	-41	-39	-36	-35	-35	-33	-34	-36	-38	-46			
				-39	-37	-35	-33	-34	-34	-34	-37	-40	-43	-46	-48	-42	-39	-37	-35	-34	-33	-32	-32	-34	-37				
					-37	-35	-33	-32	-32	-33	-35	-38	-39	-40	-44	-41	-39	-36	-34	-33	-32	-32	-32	-35					
						-36	-33	-35	-34	-34	-36	-38	-41	-42	-49	-41	-38	-36	-33	-33	-32	-31	-33						
							-37	-37	-37	-39	-39	-41	-46	-48	-49	-45	-39	-38	-37	-33	-33	-33							
										-41	-41	-45	-49	-50	-54	-47	-43	-40	-43										

Figure A90

Wavefront Plot - Q Polarization

Cube #2RW

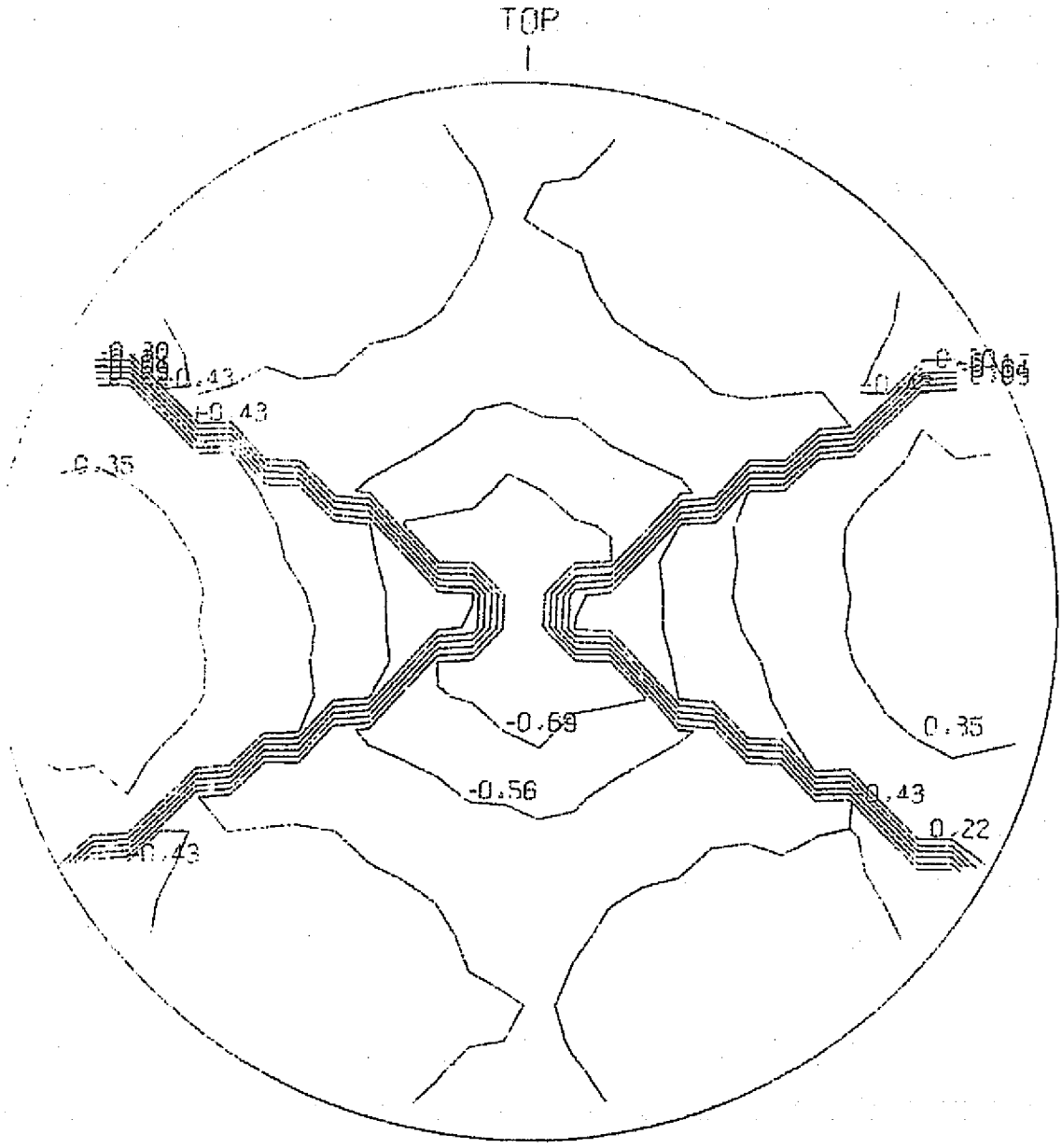


Figure A91

Wavefront Map - P Polarization

Cube #2RW

MAP IN UNITS OF 0.01 WAVES


```
                                                15  17  14  10   4 -41 -41 -37 -33 -33
                                        24  24  24  20  19  18  12   8 -39 -38 -33 -31 -30 -28 -29 -28
                                    25  26  25  25  24  21  19  17   8 -34 -33 -29 -27 -26 -25 -26 -25 -27
                                22  25  25  25  25  24  22  19  17  13 -32 -30 -30 -27 -25 -24 -24 -25 -27 -29
                            20  23  25  25  24  23  22  20  19  15  10 -37 -34 -31 -29 -26 -25 -25 -25 -26 -28 -30
                        11  15  21  24  25  23  23  21  18  16  13   9 -44 -35 -32 -30 -27 -25 -27 -25 -25 -28 -33 -36
                    9  10  15  20  20  21  21  20  18  16  15  10   2 -41 -37 -34 -32 -30 -28 -28 -28 -27 -29 -33 -38 -44
                37  11  11  12  17  18  17  20  17  14  14  10   7   9 -40 -40 -39 -35 -34 -30 -30 -30 -31 -31 -36 -39 -34  -9
                41  41  41  11  16  15  12  14  14  11  10   9   4   5 -43 -42 -40 -38 -36 -34 -33 -33 -34 -34 -36  -6  -2  -6
            -43 -44  44 -43  10  14 -10 -10   9   8   7   5   0  -2 -48 -48 -44 -42 -39 -38 -38 -39 -40 -33  -3   0  -3  -2
        46  46  48  47  45  41  46   9   7   7   7   3   0  -2  -7 -54 -51 -49 -46 -43 -42 -34 -35  -7  -1   0   2   1   2   0
        52  54  55  51  48  46  42  37  33   6   0  -4  -7  -6 -14 -60 -55 -53 -51 -50 -42  -7  -3  -3   0   2   3   5   3   3
        54  56  56  54  52  47  43  39  35  32  26 -11 -11 -14 -18 -68 -61 -59 -57 -19 -14  -9  -6  -2   1  -3   6  -7   8   6
        57  58  57  55  53  50  45  41  35  31  25  22 -14 -14 -16 -69 -65 -62 -28 -20 -15 -10  -5  -1   1   4   6   8   9   9
        59  59  57  55  54  51  46  42  35  32  26  23  15  13 -15 -67 -40 -33 -27 -22 -14  -9  -5  -2   1   5   6   8  10  10
        60  60  58  56  55  51  47  44  40  35  27  22  16   9 -56  -3 -36 -34 -26 -23 -17 -10  -7  -3   1   4   5   7   9   9
        58  59  58  56  54  51  48  44  39  34  29  21 -50 -53 -58  -5  -2  -2 -27 -24 -18 -14  -8  -4   0   3   5   7   8   8
        56  58  57  56  53  51  47  43  40  35  30 -45 -48 -49 -56  -6  -2   0   0 -23 -17 -14 -10  -6  -2   2   4   6   6   4
        53  53  55  53  52  49  46  45  42 -30 -38 -39 -42 -43 -49  -2   5   3   7  11  17 -16 -12  -7  -3   0   1   5   4   2
        49  52  51  52  49  46  42 -24 -23 -30 -32 -35 -37 -39 -42   4   8  11  14  18  18  19  21  -3  -8  -4  -2  -1  -3  -3
            47  46  50  46 -22 -28 -28 -27 -26 -28 -31 -32 -36 -36   9  12  16  19  20  21  22  21  25  22  -6  -4  -5  -6
            43  47  43 -24 -22 -22 -22 -21 -22 -24 -26 -29 -31 -31  17  16  20  22  22  25  25  24  27  28  22  -8  -8  -8
            40 -22 -27 -24 -20 -19 -19 -18 -19 -22 -23 -27 -28 -28  21  19  22  25  26  29  32  29  20  29  24  23  23 -12
               -22 -27 -22 -17 -19 -17 -16 -16 -19 -21 -23 -25 -30  14  22  26  28  30  31  32  33  32  32  27  22  21
                   -24 -22 -17 -14 -14 -15 -14 -16 -19 -20 -24 -32  20  25  28  30  33  34  35  36  36  33  31  23
                       -19 -17 -15 -13 -14 -14 -14 -17 -20 -23 -26  23  27  30  32  34  35  36  37  37  35  32
                           -17 -15 -13 -12 -12 -13 -15 -18 -19 -20  25  28  31  33  35  37  37  37  37  34
                               -15 -13 -15 -14 -14 -16 -17 -21 -22  20  29  31  33  36  37  37  38  36
                                   -17 -17 -17 -19 -19 -21 -26 -27  20  24  30  31  32  36  36  36
                                               -21 -21 -25 -29 -29  15  22  26  29  27
```

Figure A92

Wavefront Plot - P Polarization

Cube #2RW

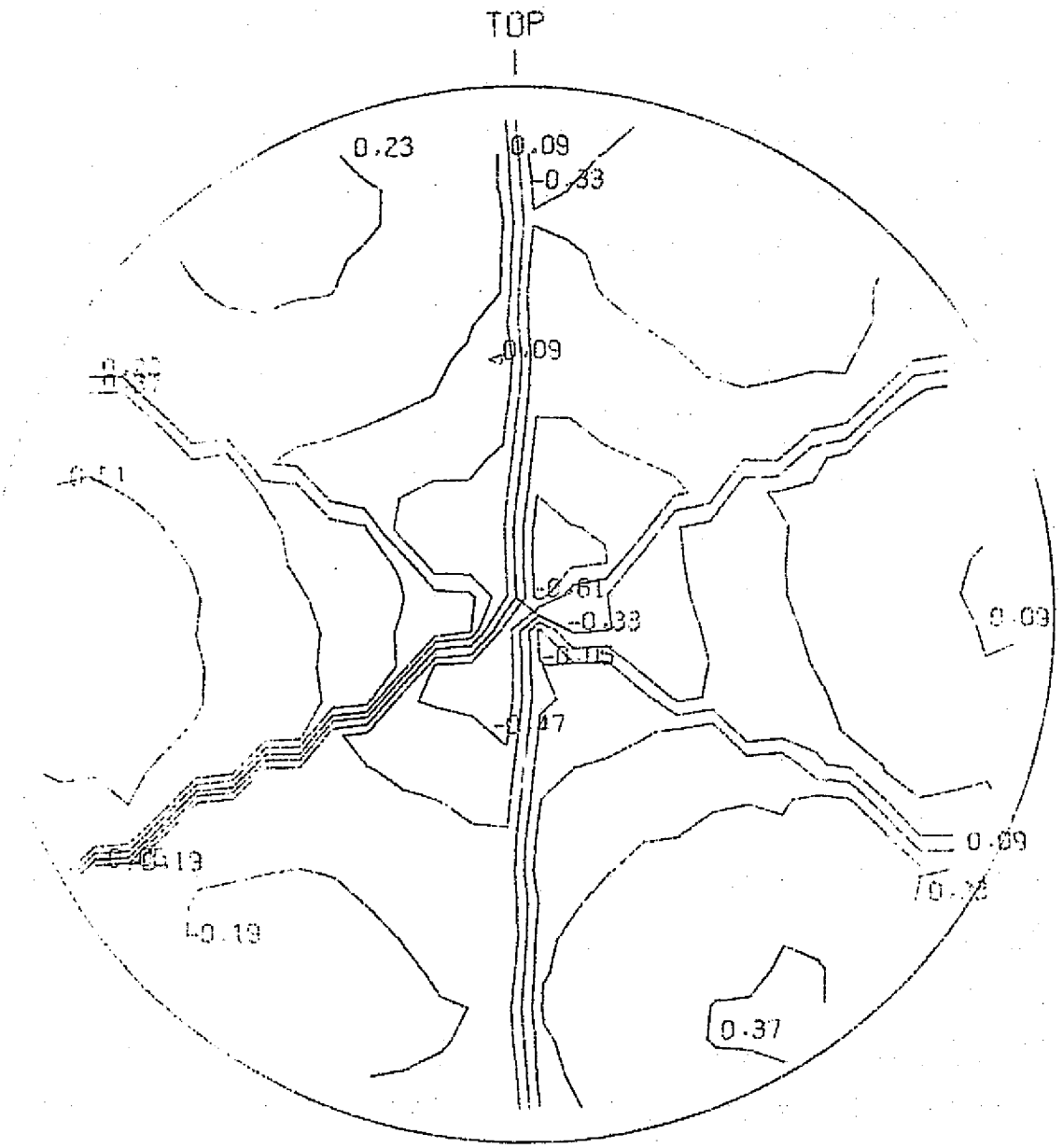
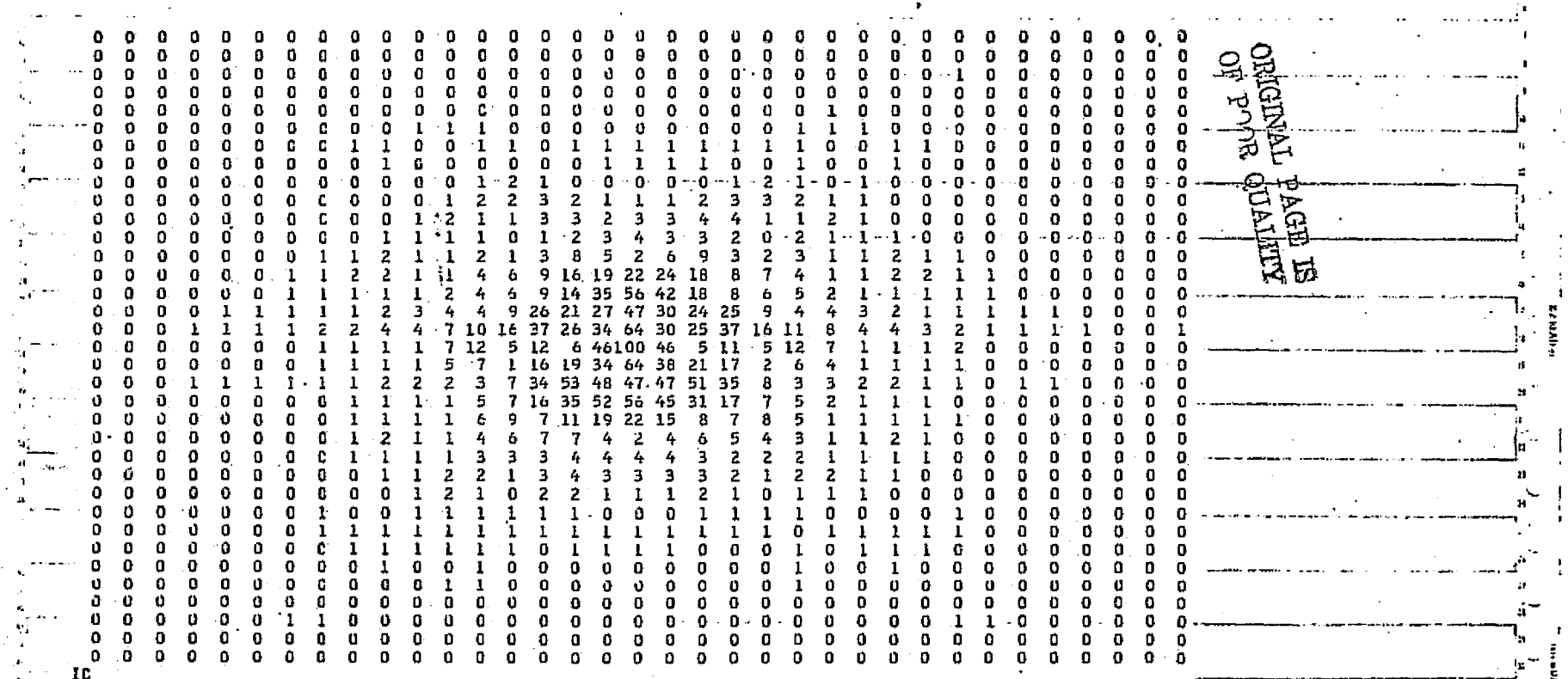


Figure A93

PRINTER MAP OF POINT SPREAD FUNCTION
Cube #2RW
(ONE SPACE REPRESENTS 8.04 MICRONS)
NORMALIZED SO LARGEST VALUE = 0.0834 = 100
TOTAL ENERGY = 0.24610000+01
MAP REPRESENTS 0.2303320D+01 OR 93.5929 PERCENT OF TOTAL ENERGY



IC
IC

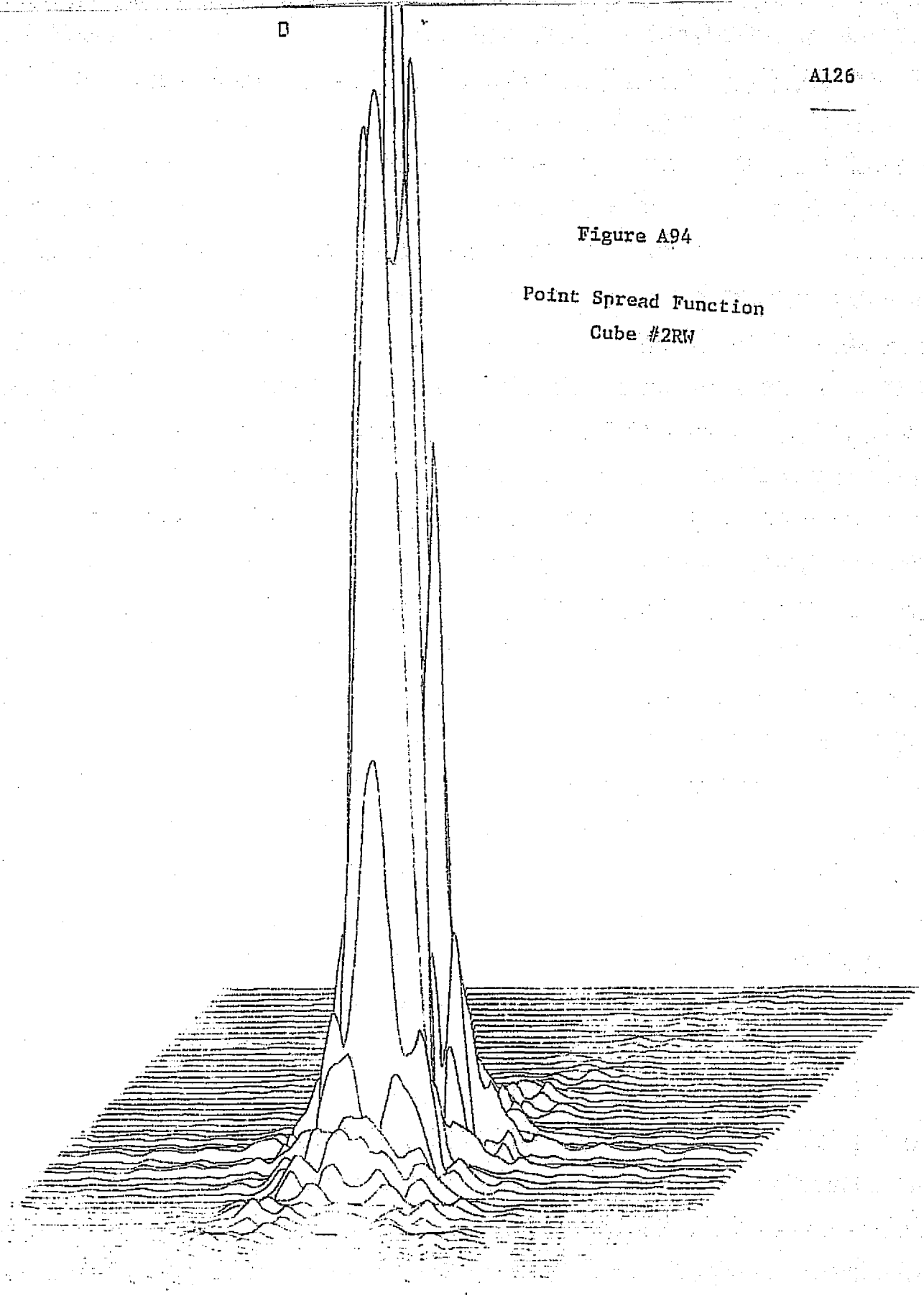


Figure A94

Point Spread Function
Cube #2RW

Figure A95

Intensity Distribution - Central 129 Microradians

Cube #2RW

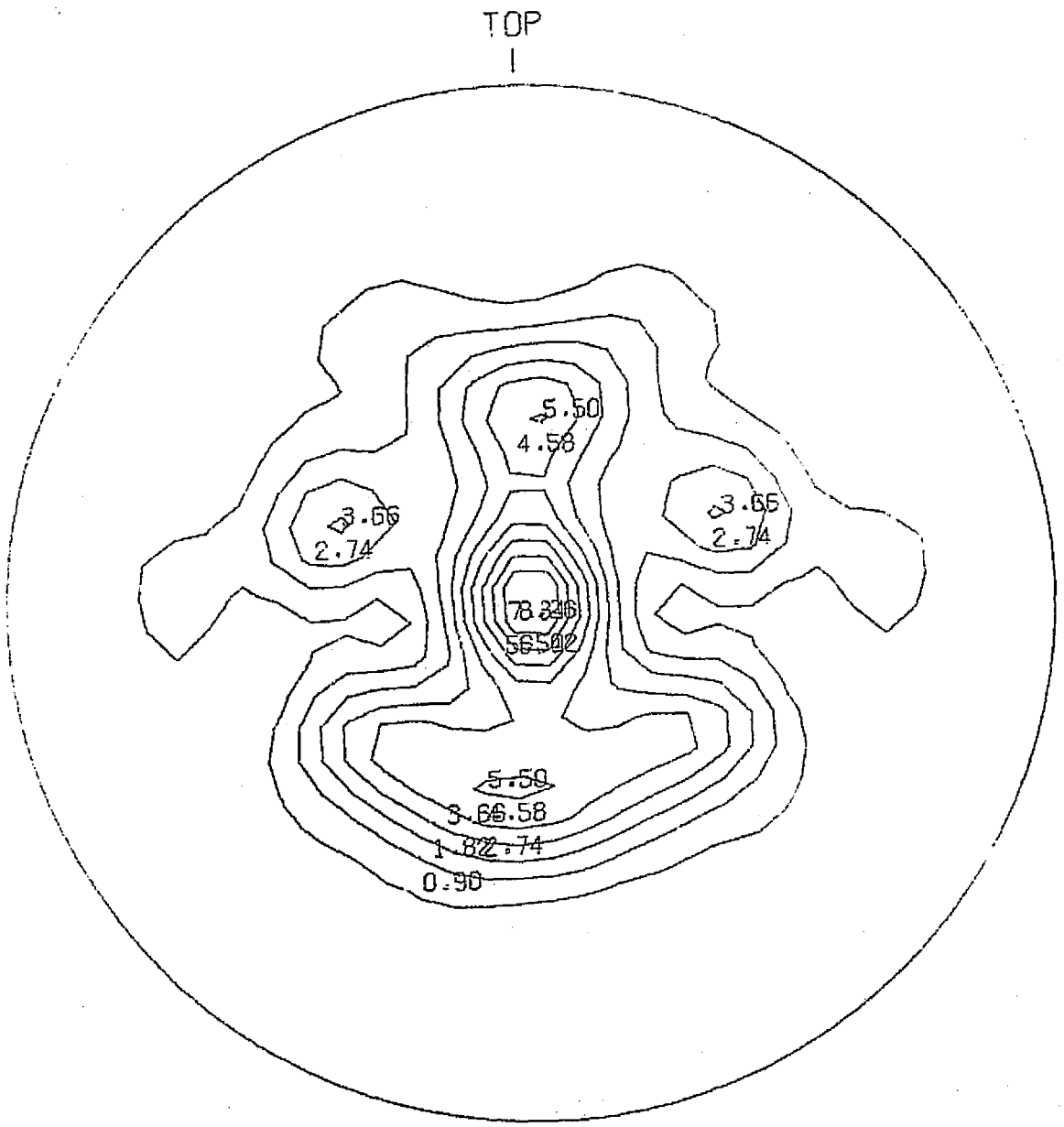


Figure A96

Encircled Energy
Vs
Field Angle

Cube #2RW

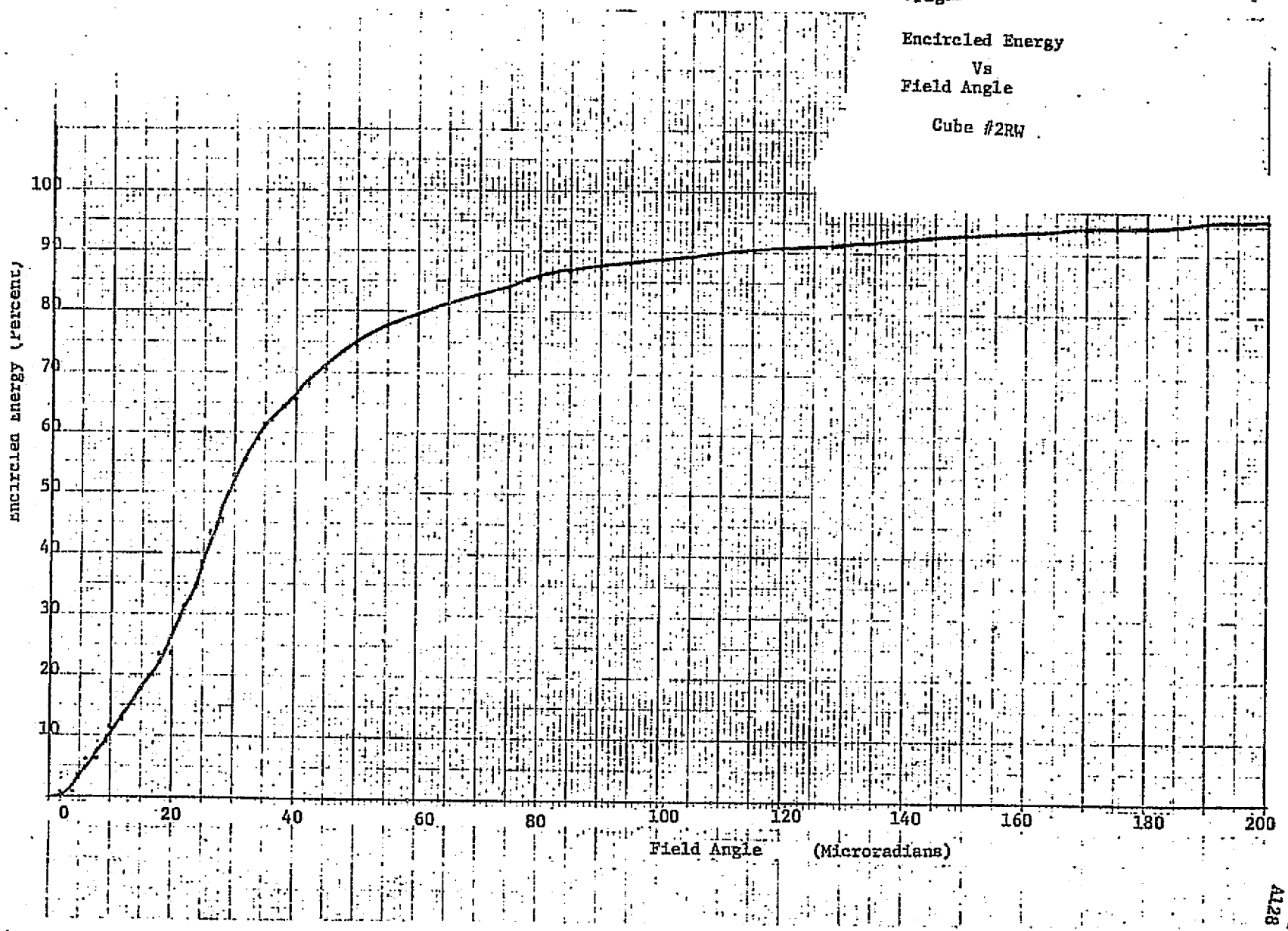


Table A32

ENCIRCLED ENERGY

Cube #2RW

CIRCLE RADIUS (MICRONS)	PERCENT ENERGY WITHIN CIRCLE CENTERED AT INDICATED COORDINATES								
CENTER (MICRONS): X=	-10.13	10.13	0.0	-10.13	0.0	10.13	0.0	-10.13	10.13
Y=	-10.13	-10.13	-10.13	0.0	0.0	0.0	10.13	10.13	10.13
2.00	0.0	0.0	0.4	0.2	0.8	0.2	0.4	0.0	0.0
4.00	0.9	0.9	1.0	0.5	0.8	0.5	1.0	1.1	1.2
6.00	0.9	0.9	2.9	1.6	6.1	1.6	3.0	1.1	1.2
8.00	3.1	3.0	5.6	3.7	6.1	3.7	5.8	3.8	3.9
10.00	4.4	4.3	7.0	4.7	11.1	4.7	7.5	5.3	5.4
12.00	9.7	9.8	11.2	8.6	12.3	8.6	12.1	11.4	11.4
14.00	9.7	9.8	14.1	12.5	15.6	12.5	16.0	11.4	11.4
16.00	16.1	16.4	18.1	16.2	17.5	16.2	20.5	18.6	18.3
18.00	18.8	19.1	21.0	20.1	23.4	20.2	24.1	21.6	21.4
20.00	23.2	23.7	25.7	25.1	23.4	25.1	29.6	26.5	26.0
22.00	25.8	26.3	28.9	30.0	31.3	30.1	33.1	29.4	28.9
24.00	30.8	31.3	32.0	32.6	35.0	32.7	36.3	34.3	33.8
26.00	33.1	33.4	36.0	38.0	43.2	38.1	39.9	36.8	36.4
28.00	37.8	38.1	40.6	43.0	45.4	43.1	44.6	40.8	40.6
30.00	41.2	41.3	44.4	47.3	52.6	47.3	47.0	44.3	44.2
32.00	47.3	47.2	48.6	50.9	55.4	50.9	50.8	49.3	49.4
34.00	48.3	48.2	52.4	55.3	59.0	55.3	53.6	50.4	50.5
36.00	54.5	54.3	56.9	58.8	61.9	58.7	57.5	55.5	55.6
38.00	57.0	56.9	60.0	61.9	64.4	61.8	59.6	57.7	57.7
40.00	61.0	60.9	63.5	64.6	65.6	64.6	63.0	61.3	61.3
42.00	63.2	63.2	66.1	67.1	68.1	67.0	65.5	63.3	63.2
44.00	66.6	66.6	68.0	68.4	69.4	68.3	67.8	66.4	66.3
46.00	68.3	68.3	69.9	70.1	71.7	70.1	70.0	68.2	68.1
48.00	70.3	70.4	71.6	71.6	72.3	71.5	72.1	70.5	70.3
50.00	71.6	71.8	72.8	72.5	74.4	72.5	73.4	72.2	72.0
52.00	73.2	73.2	74.0	74.0	75.3	73.9	74.8	73.7	73.5
54.00	74.0	74.1	75.3	75.1	76.6	75.0	76.0	74.7	74.5
56.00	75.5	75.5	76.5	76.5	77.3	76.5	77.3	76.1	76.0
58.00	76.5	76.5	77.4	77.4	78.4	77.4	77.9	77.1	77.1
60.00	77.7	77.6	78.4	78.6	79.1	78.5	78.8	78.1	78.1
62.00	78.5	78.4	79.2	79.5	79.9	79.4	79.5	78.8	78.8
64.00	79.7	79.6	79.9	80.2	80.6	80.2	80.1	79.8	79.9
66.00	80.4	80.3	80.8	81.1	81.3	81.1	80.8	80.5	80.5
68.00	81.3	81.2	81.4	81.7	81.7	81.7	81.4	81.3	81.4
70.00	81.8	81.8	82.2	82.4	82.4	82.3	82.1	81.8	81.9
72.00	82.7	82.6	82.7	82.9	83.0	82.9	82.7	82.6	82.7
74.00	83.0	83.0	83.4	83.5	83.6	83.5	83.4	83.0	83.1
76.00	83.8	83.7	83.9	84.1	84.1	84.1	84.0	83.7	83.8
78.00	84.2	84.2	84.4	84.4	84.8	84.4	84.5	84.2	84.3
80.00	84.7	84.7	84.9	84.9	85.3	85.0	85.0	84.7	84.8

Table A33

ENCIRCLED ENERGY

Cube #2RW

CIRCLE RADIUS (MICRONS)	PERCENT ENERGY WITHIN CIRCLE CENTERED AT INDICATED COORDINATES								
CENTER (MICRONS): X=	-10.13	10.13	0.0	-10.13	0.0	10.13	0.0	-10.13	10.13
Y=	-10.13	-10.13	-10.13	0.0	0.0	0.0	10.13	10.13	10.13
5.00	0.9	0.9	2.5	1.6	3.7	1.6	2.6	1.1	1.2
10.00	4.4	4.3	7.0	4.7	11.1	4.7	7.5	5.3	5.4
15.00	13.6	13.8	17.4	14.7	17.5	14.8	19.3	15.7	15.5
20.00	23.2	23.7	25.7	25.1	23.4	25.1	29.6	26.5	26.0
25.00	32.3	32.8	35.0	37.4	38.5	37.4	39.3	35.9	35.5
30.00	41.2	41.3	44.4	47.3	52.6	47.3	47.0	44.3	44.2
35.00	52.5	52.3	54.8	56.6	61.1	56.6	55.4	53.4	53.6
40.00	61.0	60.9	63.5	64.6	65.6	64.6	63.0	61.3	61.3
45.00	67.5	67.6	69.2	69.5	70.7	69.4	69.0	67.6	67.4
50.00	71.6	71.8	72.8	72.5	74.4	72.5	73.4	72.2	72.0
55.00	75.0	75.0	75.9	76.0	77.2	75.9	76.6	75.5	75.4
60.00	77.7	77.6	78.4	78.6	79.1	78.5	78.8	78.1	78.1
65.00	80.0	79.9	80.5	80.7	81.0	80.7	80.5	80.1	80.2
70.00	81.8	81.8	82.2	82.4	82.4	82.3	82.1	81.8	81.9
75.00	83.5	83.5	83.7	83.8	83.9	83.8	83.7	83.4	83.5
80.00	84.7	84.7	84.9	84.9	85.3	85.0	85.0	84.7	84.8
85.00	85.7	85.7	86.1	86.1	86.5	86.1	86.3	85.8	85.9
90.00	86.7	86.7	87.0	87.0	87.3	87.0	87.1	86.8	86.9
95.00	87.7	87.7	87.8	87.8	87.9	87.8	87.8	87.8	87.8
100.00	88.4	88.4	88.4	88.5	88.5	88.5	88.5	88.5	88.5
105.00	89.0	89.0	89.1	89.1	89.1	89.1	89.2	89.0	89.1
110.00	89.6	89.6	89.7	89.7	89.8	89.7	89.8	89.6	89.7
115.00	90.2	90.2	90.2	90.2	90.4	90.2	90.3	90.2	90.2
120.00	90.7	90.7	90.8	90.8	90.9	90.8	90.8	90.7	90.7
125.00	91.1	91.1	91.3	91.2	91.3	91.2	91.2	91.1	91.1
130.00	91.6	91.5	91.6	91.6	91.6	91.6	91.6	91.5	91.5
135.00	91.9	91.9	91.9	91.9	91.9	91.9	91.9	91.9	91.9
140.00	92.3	92.3	92.3	92.3	92.2	92.3	92.2	92.2	92.3
145.00	92.7	92.7	92.7	92.7	92.5	92.7	92.6	92.6	92.6
150.00	93.0	93.0	93.1	93.0	93.1	93.0	93.0	93.0	93.0
155.00	93.3	93.3	93.4	93.3	93.5	93.3	93.4	93.3	93.3
160.00	93.7	93.7	93.7	93.7	93.7	93.7	93.7	93.7	93.7
165.00	94.0	94.0	94.0	94.0	94.0	94.0	94.0	94.0	94.0
170.00	94.2	94.3	94.3	94.3	94.3	94.3	94.3	94.3	94.3
175.00	94.5	94.5	94.5	94.6	94.5	94.6	94.5	94.5	94.5
180.00	94.8	94.8	94.9	94.9	94.9	94.9	94.8	94.8	94.8
184.99	95.1	95.1	95.1	95.1	95.1	95.1	95.1	95.1	95.1
189.99	95.4	95.4	95.4	95.4	95.4	95.3	95.4	95.4	95.4
194.99	95.6	95.6	95.7	95.6	95.7	95.6	95.7	95.6	95.6
199.99	95.9	95.9	95.9	95.9	95.9	95.9	95.9	95.9	95.9

Figure A07

Wavefront Map - Q Polarization

Cube #38W

MAP IN UNITS OF 0.01 WAVES

```
                                                -44 -49 -52 -53 -53 -53 -52 -52 -51 -47
                                        -42 -42 -43 -43 -45 -48 -48 -47 -49 -46 -47 -44 -44 -43 -41 -42
                                    -43 -40 -39 -40 -41 -42 -43 -43 -43 -43 -44 -42 -42 -41 -40 -39 -39 -41
                                -41 -40 -38 -37 -37 -38 -39 -40 -40 -44 -42 -41 -41 -40 -39 -39 -39 -40 -41 -44
                            -48 -40 -38 -37 -37 -37 -37 -38 -38 -40 -39 -45 -42 -40 -40 -39 -39 -40 -40 -40 -46 -46
                        -52 -46 -42 -37 -36 -36 -36 -38 -38 -38 -40 -42 -39 -40 -40 -39 -39 -40 -40 -40 -40 -43 -47 -51
                    -58 -52 -44 -40 -36 -37 -36 -37 -38 -39 -40 -42 -36 -41 -42 -41 -41 -40 -41 -41 -41 -41 -42 -45 -53 -55
                8 -53 -50 -43 -40 -37 -36 -38 -37 -38 -39 -41 -43 -42 -42 -42 -42 -43 -42 -42 -41 -41 -42 -41 -45 -52 -59 15
            15  20  27 -45 -42 -39 -39 -39 -39 -40 -41 -43 -45 -48 -45 -44 -45 -44 -44 -42 -42 -42 -43 -43 -40  25  27  19
            20  25  30  31 -46 -43 -39 -39 -40 -41 -42 -44 -45 -43 -53 -46 -46 -46 -44 -45 -44 -44 -47 -47 -26 -28  24  23
        21  26  29  32  24  31  33 -36 -38 -42 -43 -45 -46 -48 -47 -51 -48 -47 -47 -46 -46 -46 -42  30  27  28  30  27  24  22
        26  29  31  33  35  33  30  33  27 -48 -47 -46 -49 -51 -44 -49 -52 -50 -49 -49 -47  27  30  20  30  31  32  32  30  25
        29  31  34  35  36  35  32  30  30  24  23 -46 -50 -54 -52 -55 -53 -52 -43  26  21  28  29  30  32 -32  33  33  32  29
        29  31  25  35  35  34  33  31  28  26  24  25 -52 -56 -55 -54 -52 -49  25  25  26  28  30  31  32  33  33  34  32  31
        31  32  34  35  34  33  32  31  28  27  23  20  16  12 -66 -60  14  20  20  23  25  28  30  32  33  34  35  34  33  32
        32  33  34  35  34  33  32  30  28  25  23  20  20  14 -60 -66  12  16  20  23  27  28  31  32  33  34  35  34  32  31
        31  32  34  33  33  32  31  30  28  26  25  25 -49 -52 -54 -55 -56 -52  25  24  26  28  31  33  34  35  35  35  31  29
        29  32  33  33  32  32  30  29  28  21  26 -43 -52 -53 -55 -52 -54 -50 -46  23  24  30  30  32  35  36  35  34  31  29
    25  30  32  32  31  30  30  30  27 -47 -49 -49 -50 -52 -49 -44 -51 -49 -46 -47 -48  27  33  30  33  35  35  31  29  26
    22  24  27  30  28  27  30 -42 -46 -46 -46 -47 -47 -48 -51 -47 -48 -46 -45 -43 -42 -38 -36  33  31  34  32  29  26  21
        21  24  28  28 -47 -47 -44 -44 -45 -44 -46 -46 -46 -53 -43 -45 -40 -42 -41 -40 -39 -39 -43 -46  31  30  25  20
        19  27  25 -40 -43 -43 -42 -42 -42 -44 -44 -45 -44 -45 -48 -45 -43 -41 -40 -39 -39 -39 -39 -42 -45  27  20 -15
        15 -59 -52 -45 -41 -42 -41 -41 -42 -42 -43 -42 -42 -42 -42 -43 -41 -39 -38 -37 -38 -36 -37 -40 -43 -50 -53   8
           -55 -53 -45 -42 -41 -41 -41 -41 -40 -41 -41 -42 -41 -36 -42 -40 -39 -38 -37 -36 -37 -36 -40 -44 -52 -58
               -51 -47 -43 -40 -40 -40 -40 -39 -39 -40 -40 -39 -42 -40 -38 -38 -38 -38 -36 -36 -37 -42 -46 -52
                   -49 -44 -40 -40 -40 -39 -39 -40 -40 -42 -45 -39 -40 -38 -38 -37 -37 -37 -37 -38 -40 -48
                       -44 -41 -40 -39 -39 -39 -40 -41 -41 -42 -44 -40 -40 -39 -38 -37 -37 -38 -40 -41
                           -41 -39 -39 -40 -41 -42 -42 -44 -43 -43 -43 -43 -42 -41 -40 -39 -40 -43
                               -42 -41 -42 -44 -44 -47 -46 -49 -47 -48 -48 -45 -43 -43 -42 -42
                                   -47 -51 -52 -52 -53 -53 -53 -52 -49 -44
```

Figure A98

Wavefront Plot - Q Polarization

Cube #3RW

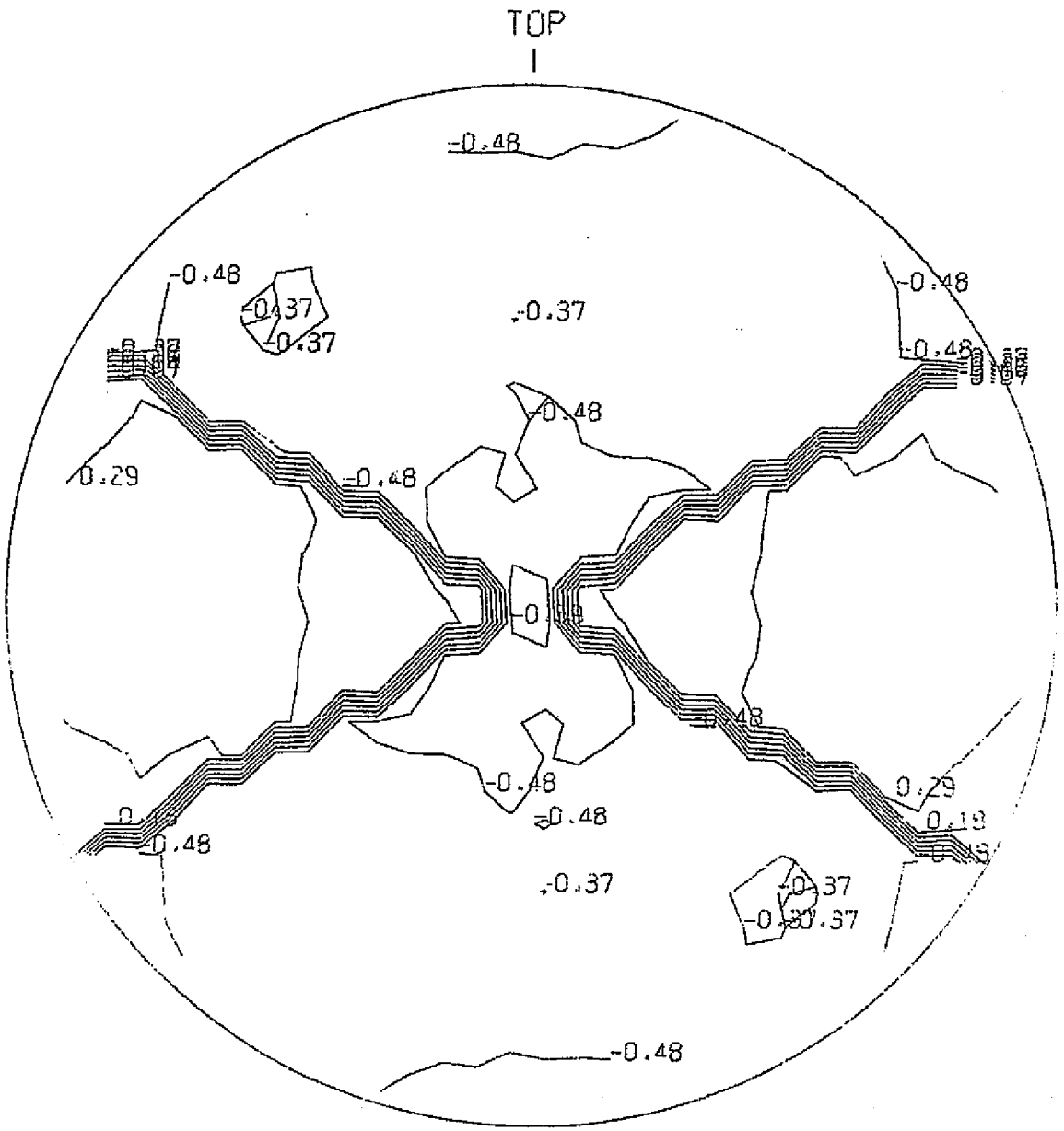


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Figure A99

Wavefront Map - P Polarization

Cube #3RW

MAP IN UNITS OF 0.01 WAVES

```
                                                  14   9   5   4   4 -45 -43 -43 -42 -38
                                          15  15  14  15  12  10  10  10 -40 -38 -38 -36 -36 -34 -33 -33
                                      14  17  18  18  16  16  15  15  15 -34 -35 -34 -33 -33 -31 -31 -31 -32
                                  16  17  20  20  21  20  19  19  17  13 -34 -32 -32 -32 -31 -31 -31 -31 -32 -36
                              10  18  19  21  21  20  20  19  20  18  18 -36 -33 -31 -32 -31 -31 -32 -31 -32 -36 -40
                          5  11  16  21  21  21  20  19  19  19  18  16 -31 -32 -31 -31 -30 -32 -32 -31 -31 -35 -38 -42
                      0   6  13  18  21  21  22  20  19  19  18  16  21 -32 -33 -32 -32 -32 -33 -33 -32 -32 -34 -37 -45 -47
                 24   4   7  14  17  20  21  20  20  19  18  17  15  15 -33 -34 -34 -34 -34 -33 -32 -32 -33 -33 -37 -44 -50 -18
                 31  36  43  12  15  16  19  19  19  18  17  14  13   9 -37 -36 -36 -36 -35 -34 -33 -34 -35 -34 -31  -8  -6 -14
                 36  41  46  47  11  15  18  18  18  17  15  14  13  14 -44 -38 -38 -38 -36 -36 -36 -36 -38 -38  -7  -5  -9 -12
             37  42  45  48  50  47  49  22  19  15  14  13  12   9  10 -43 -40 -39 -39 -38 -37 -38 -33  -3  -6  -5  -3  -6  -9 -11
             42  45  47  51  51  49  46  49  43  10  10  11   8   7  13 -41 -43 -42 -41 -41 -38  -6  -3  -3  -3  -2  -1  -1  -3  -8
             45  47  50  51  52  51  48  46  46  40  39  12   8   4   5 -46 -44 -43 -35  -7 -12  -5  -4  -3  -1  -1   0   0  -1  -4
             45  47  51  51  51  50  49  47  44  42  40  41   6   1   2 -46 -44 -40  -8  -7  -7  -5  -3  -2  -1   0   0   0  -1  -1
             47  48  50  51  50  49  48  47  44  43  39  36  32  28  -7 -52 -19 -13 -13 -10  -8  -4  -3  -1   0   0   1   0   0  -1
             48  49  50  51  50  49  48  46  44  41  39  36  36  30 -40   3 -21 -17 -13 -10  -6  -5  -2  -1   0   0   1   0  -1  -2
             47  48  50  49  49  48  47  46  44  42  41  41 -28 -32 -34  14  13  17  -8  -9  -7  -5  -2   0   0   1   1   1  -2  -4
             45  48  49  49  48  48  46  45  44  37  42 -23 -32 -33 -35  17  15  20  23 -10  -9  -3  -3  -1   1   2   2   0  -2  -4
             41  46  48  48  47  46  46  46  43 -27 -29 -29 -30 -31 -29  25  19  20  23  22  21  -6   0  -3   0   1   1  -2  -4  -7
             38  40  43  46  44  43  46 -22 -26 -25 -26 -27 -27 -28 -31  22  21  24  25  26  27  31  33   0  -2   0  -1  -4  -7 -12
                 37  40  44  42 -26 -27 -24 -24 -24 -24 -26 -26 -26 -33  26  24  26  27  29  29  30  30  26  23  -2  -3  -8 -13
                 35  43  41 -20 -23 -23 -22 -21 -22 -24 -24 -25 -24 -25  21  25  26  28  30  30  30  31  30  27  24  -6 -13 -18
                 31 -38 -32 -25 -21 -22 -21 -21 -22 -22 -23 -22 -22 -21  27  27  28  30  31  32  32  33  32  29  26  19  16 -25
                    -35 -33 -25 -22 -21 -21 -21 -21 -20 -21 -21 -22 -21  33  27  30  30  31  32  33  33  33  30  25  18  12
                        -30 -27 -23 -19 -20 -20 -20 -19 -19 -19 -20 -19  27  29  31  31  31  31  33  33  32  28  23
                            -29 -24 -20 -19 -20 -19 -19 -20 -20 -21 -25  30  29  31  31  32  32  33  33  31  29  21
                                -24 -21 -20 -19 -19 -19 -20 -21 -21 -22  25  29  30  31  32  32  32  31  29  28
                                    -21 -19 -19 -20 -21 -22 -22 -23 -23  27  26  26  28  28  29  30  29  26
                                        -22 -21 -22 -24 -24 -27 -26 -29  22  21  22  24  26  26  27  27
                                                -27 -30 -32 -32 -33  16  16  17  20  25
```

Figure A100

Wavefront Plot - P Polarization

Cube #3RW

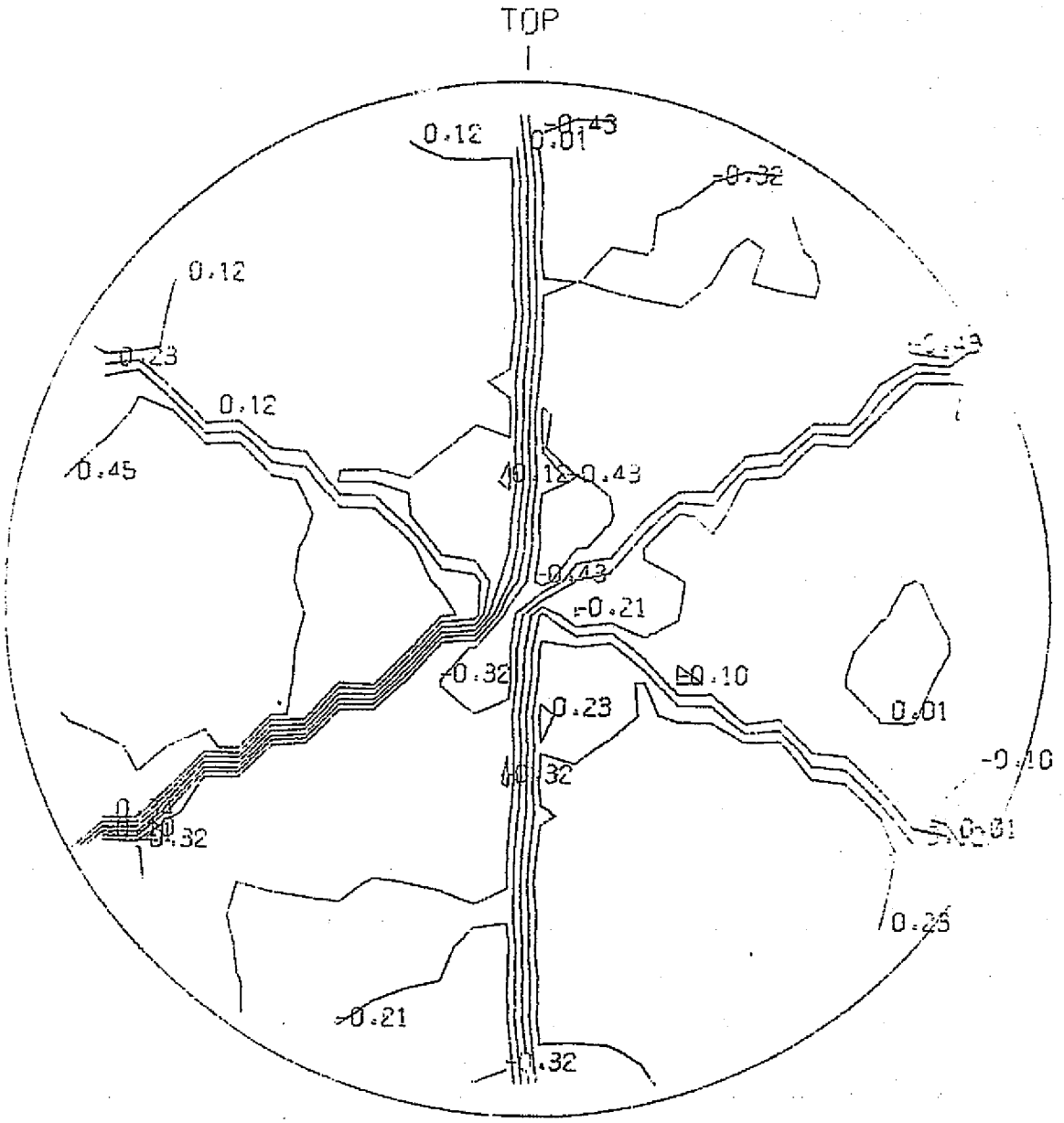

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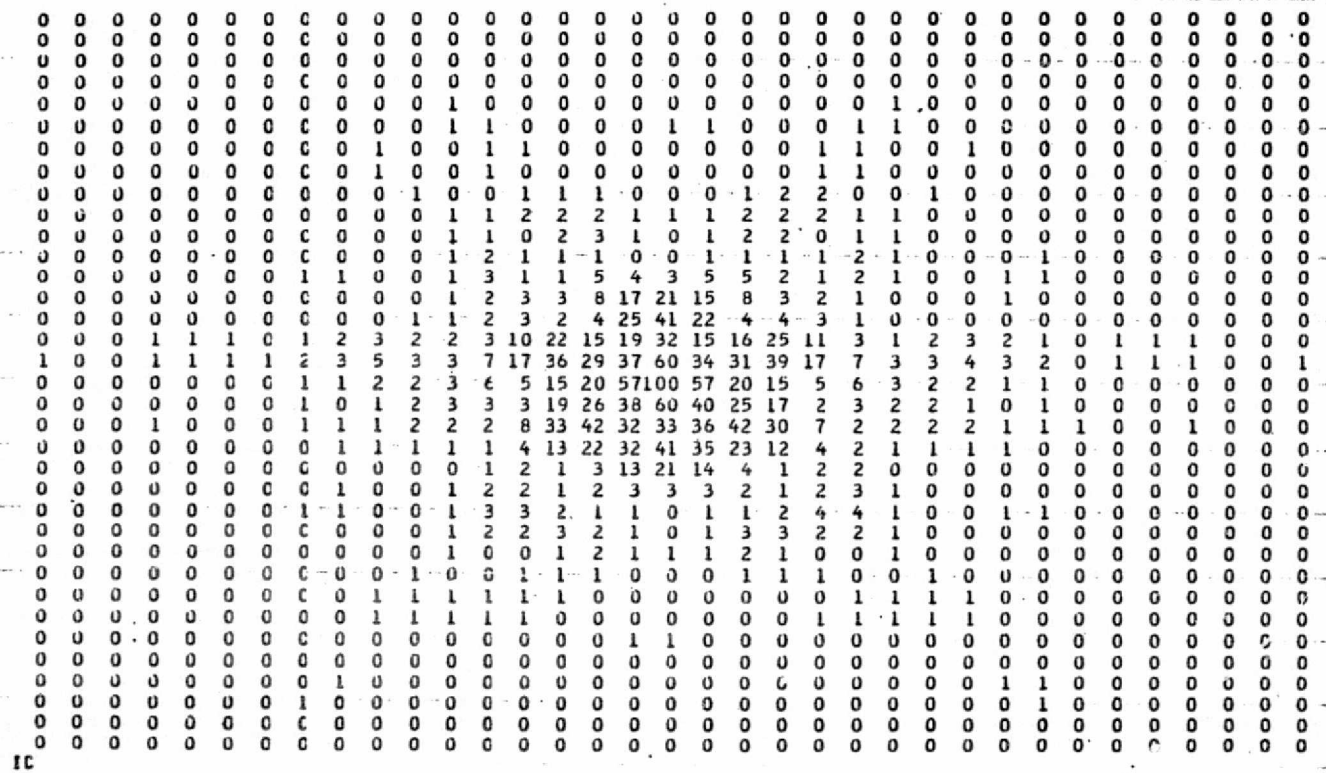
Figure A101

PRINTER MAP OF POINT SPREAD FUNCTION
Cube #3RW
(ONE SPACE REPRESENTS 8.04 MICRONS)
NORMALIZED SO LARGEST VALLE = 0.1041 = 100
TOTAL ENERGY = 0.2461000D+01
MAP REPRESENTS C.2306964D+01 OR 93.7409 PERCENT OF TOTAL ENERGY



IC
IC

Figure A102

Point Spread Function

Cube #3RW

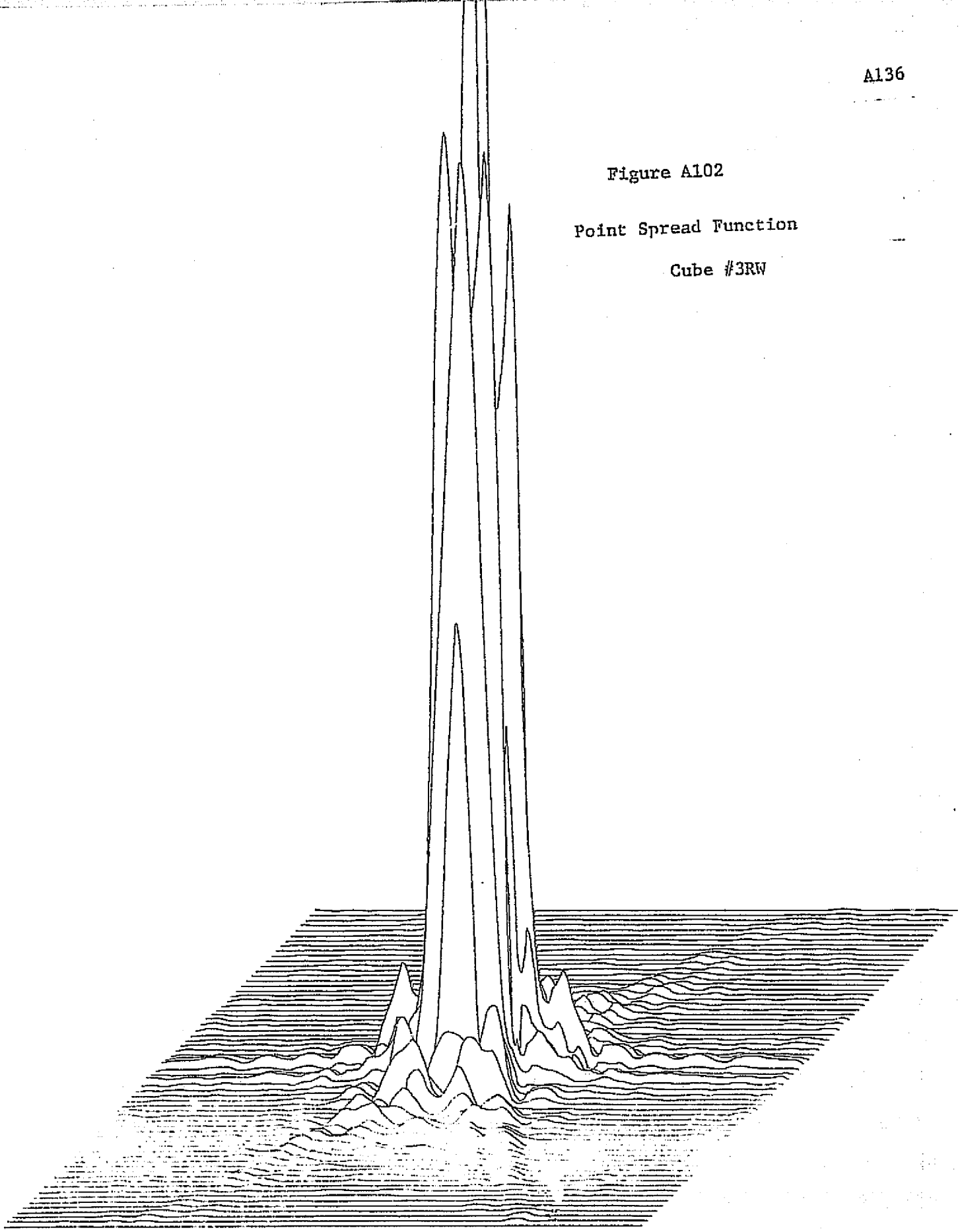


Figure A103

Intensity Distribution - Central 129 Microradians

Cube #3RW

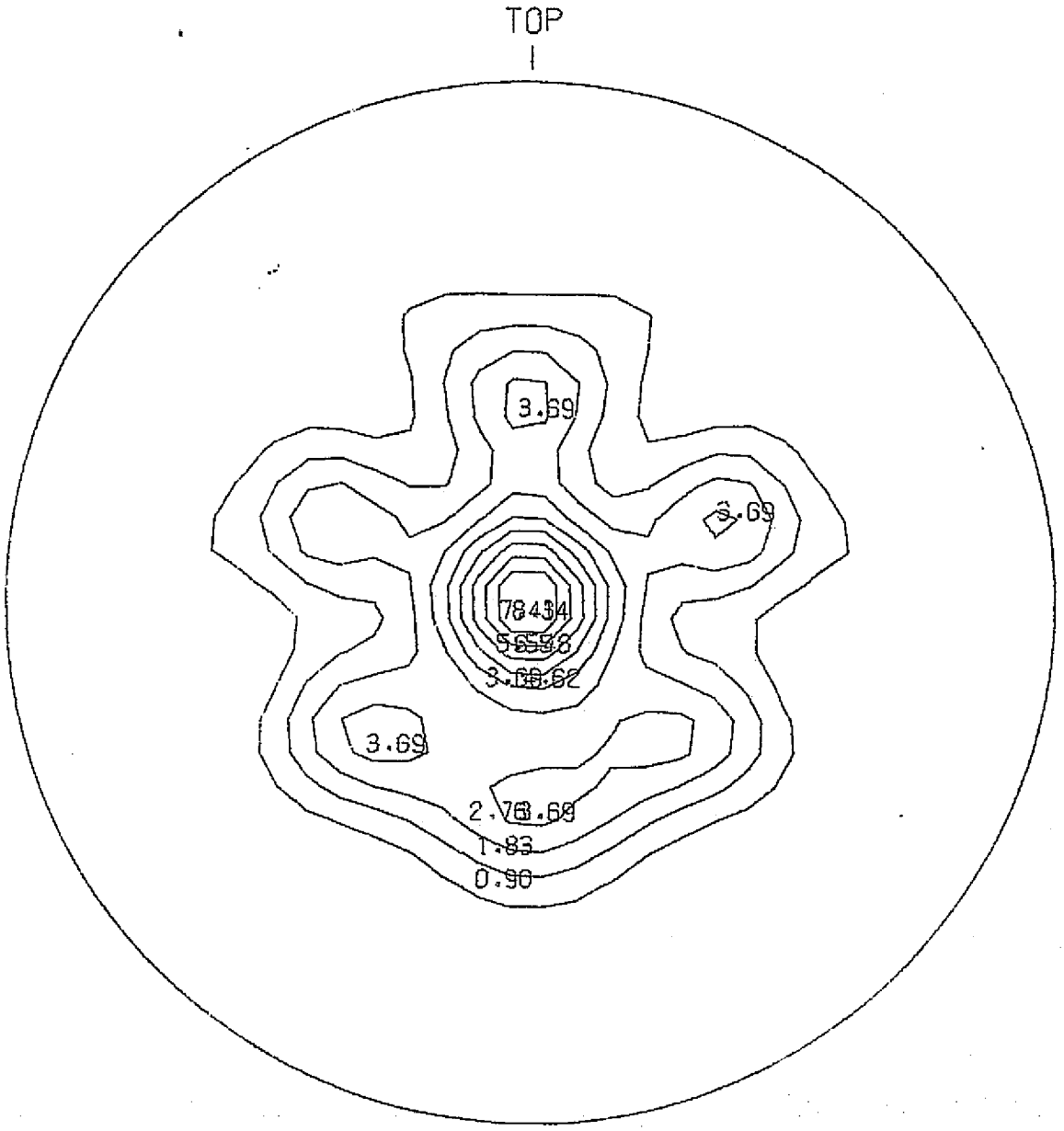


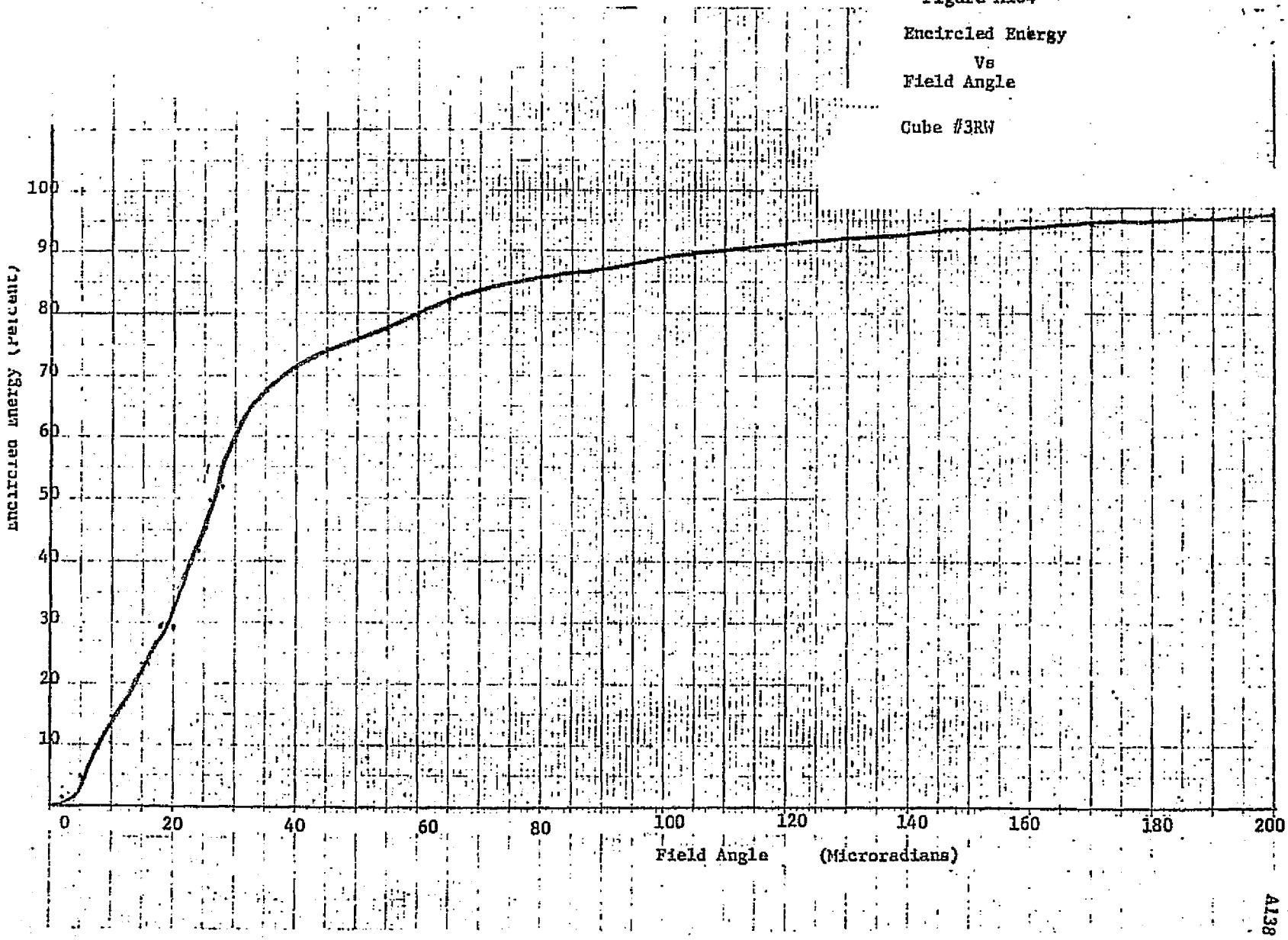
Figure A104

Encircled Energy

Vs

Field Angle

Cube #3RW



A138

Table A34

ENCIRCLED ENERGY

Cube #3RW

CIRCLE RADIUS (MICRONS)	PERCENT ENERGY WITHIN CIRCLE CENTERED AT INDICATED COORDINATES								
	CENTER (MICRONS):								
	X= -10.13	10.13	0.0	-10.13	0.0	10.13	0.0	-10.13	10.13
	Y= -10.13	-10.13	-10.13	0.0	0.0	0.0	10.13	10.13	10.13
2.00	0.0	0.0	0.4	0.4	1.1	0.4	0.4	0.0	0.0
4.00	1.2	1.1	1.1	1.0	1.1	1.0	1.1	1.4	1.5
6.00	1.2	1.1	3.2	2.9	7.8	2.9	3.3	1.4	1.5
8.00	3.9	3.7	6.2	5.9	7.8	5.8	6.5	4.6	4.8
10.00	5.4	5.2	7.8	7.4	14.6	7.4	8.4	6.4	6.5
12.00	11.7	11.5	12.8	12.4	16.2	12.4	13.8	13.4	13.6
14.00	11.7	11.5	16.4	16.9	20.6	16.9	18.6	13.4	13.6
16.00	19.2	19.2	21.0	21.5	23.0	21.5	23.8	21.7	21.8
18.00	22.2	22.3	24.6	25.5	29.7	25.5	28.2	25.3	25.3
20.00	27.3	27.5	30.1	31.4	29.7	31.4	34.6	30.8	30.6
22.00	30.4	30.6	33.9	35.9	37.9	35.9	39.0	34.3	34.1
24.00	36.0	36.2	37.3	39.2	41.5	39.2	42.5	39.9	39.7
26.00	38.4	38.6	41.9	44.1	49.7	44.1	46.8	42.7	42.5
28.00	43.3	43.6	46.5	49.3	51.9	49.3	51.7	47.0	46.8
30.00	46.8	46.9	50.8	53.1	59.1	53.1	54.3	50.7	50.6
32.00	52.7	52.8	54.6	56.8	61.8	56.8	57.7	55.4	55.4
34.00	53.7	53.7	58.7	60.6	65.6	60.7	60.5	56.4	56.5
36.00	59.6	59.5	62.8	63.9	68.1	63.9	63.8	60.9	61.0
38.00	62.0	61.8	65.7	66.9	70.3	66.9	65.2	62.7	62.8
40.00	65.6	65.4	68.9	69.2	71.3	69.2	68.0	65.7	65.9
42.00	67.7	67.5	71.0	71.2	73.0	71.2	69.7	67.3	67.5
44.00	70.8	70.6	72.5	72.5	73.6	72.5	71.5	69.9	70.1
46.00	72.2	72.0	73.8	73.6	74.8	73.6	72.9	71.3	71.5
48.00	74.0	73.8	75.0	74.7	75.0	74.7	74.5	73.3	73.5
50.00	75.0	74.9	75.6	75.2	75.9	75.2	75.4	74.6	74.8
52.00	76.2	76.1	76.3	76.3	76.4	76.3	76.4	75.9	76.0
54.00	76.7	76.6	77.1	76.9	77.1	76.9	77.4	76.7	76.8
56.00	77.7	77.6	77.8	77.9	77.6	77.9	78.4	77.9	77.9
58.00	78.2	78.2	78.4	78.4	78.6	78.4	79.0	78.7	78.7
60.00	79.0	79.0	79.0	79.3	79.4	79.3	79.7	79.5	79.4
62.00	79.5	79.5	79.9	80.0	80.3	80.0	80.5	80.0	79.9
64.00	80.4	80.4	80.4	80.7	81.2	80.7	80.9	80.9	80.8
66.00	80.9	80.9	81.4	81.5	82.2	81.5	81.7	81.3	81.2
68.00	81.7	81.8	81.9	82.2	82.6	82.2	82.2	82.0	81.9
70.00	82.2	82.2	82.8	82.9	83.4	82.9	82.8	82.5	82.3
72.00	83.0	83.1	83.3	83.5	83.9	83.5	83.3	83.2	83.1
74.00	83.4	83.5	84.1	84.1	84.5	84.1	83.9	83.5	83.4
76.00	84.2	84.3	84.6	84.7	84.8	84.6	84.4	84.2	84.1
78.00	84.6	84.7	85.1	85.0	85.3	84.9	84.8	84.6	84.5
80.00	85.2	85.3	85.5	85.4	85.6	85.4	85.3	85.1	85.0

Table A35

ENCIRCLED ENERGY

Cube #3RW

CIRCLE RADIUS (MICRONS)	PERCENT ENERGY WITHIN CIRCLE CENTERED AT INDICATED COORDINATES								
CENTER (MICRONS): X=	-10.13	10.13	0.0	-10.13	0.0	10.13	0.0	-10.13	10.13
Y=	-10.13	-10.13	-10.13	0.0	0.0	0.0	10.13	10.13	10.13
5.00	1.2	1.1	2.8	2.7	4.7	2.7	3.0	1.4	1.5
10.00	5.4	5.2	7.8	7.4	14.6	7.4	8.4	6.4	6.5
15.00	16.2	16.2	20.0	19.9	23.0	19.9	22.3	18.4	18.5
20.00	27.3	27.5	30.1	31.4	29.7	31.4	34.6	30.8	30.6
25.00	37.6	37.9	41.0	43.3	45.1	43.3	46.2	41.7	41.5
30.00	46.8	46.9	50.8	53.1	59.1	53.1	54.3	50.7	50.6
35.00	57.7	57.6	60.8	62.1	67.5	62.1	61.9	59.1	59.1
40.00	65.6	65.4	68.9	69.2	71.3	69.2	68.0	65.7	65.9
45.00	71.6	71.4	73.4	73.1	74.3	73.1	72.4	70.9	71.1
50.00	75.0	74.9	75.6	75.2	75.9	75.2	75.4	74.6	74.8
55.00	77.3	77.3	77.4	77.5	77.5	77.5	77.8	77.4	77.4
60.00	79.0	79.0	79.0	79.3	79.4	79.3	79.7	79.5	79.4
65.00	80.6	80.7	81.0	81.2	81.7	81.2	81.4	81.1	81.0
70.00	82.2	82.2	82.8	82.9	83.4	82.9	82.8	82.5	82.3
75.00	83.9	84.0	84.3	84.4	84.7	84.4	84.1	83.9	83.8
80.00	85.2	85.3	85.5	85.4	85.6	85.4	85.3	85.1	85.0
85.00	86.1	86.2	86.5	86.3	86.5	86.3	86.4	86.1	86.1
90.00	87.0	87.0	87.2	87.0	87.2	87.0	87.3	87.0	87.0
95.00	87.8	87.8	87.8	87.8	87.9	87.8	88.0	87.9	87.9
100.00	88.4	88.4	88.4	88.5	88.6	88.5	88.6	88.5	88.5
105.00	89.0	89.0	89.1	89.2	89.3	89.2	89.2	89.1	89.1
110.00	89.7	89.7	89.8	89.8	89.9	89.8	89.7	89.7	89.7
115.00	90.3	90.3	90.3	90.3	90.4	90.3	90.3	90.3	90.2
120.00	90.8	90.8	90.9	90.8	90.9	90.8	90.8	90.8	90.8
125.00	91.2	91.2	91.3	91.2	91.3	91.3	91.3	91.2	91.2
130.00	91.6	91.6	91.7	91.7	91.8	91.7	91.8	91.7	91.7
135.00	92.0	92.0	92.0	92.1	92.2	92.1	92.1	92.1	92.1
140.00	92.5	92.5	92.6	92.6	92.5	92.6	92.5	92.4	92.4
145.00	92.8	92.8	92.9	92.9	92.8	92.9	92.9	92.8	92.8
150.00	93.2	93.2	93.2	93.2	93.3	93.2	93.2	93.2	93.2
155.00	93.5	93.5	93.6	93.5	93.6	93.5	93.6	93.5	93.6
160.00	93.9	93.9	93.8	93.9	93.8	93.9	93.9	93.9	93.9
165.00	94.2	94.1	94.2	94.2	94.2	94.2	94.2	94.1	94.2
170.00	94.4	94.4	94.5	94.5	94.6	94.5	94.5	94.4	94.4
175.00	94.7	94.7	94.7	94.7	94.7	94.7	94.7	94.7	94.7
180.00	94.9	95.0	95.0	95.0	95.0	95.0	95.0	95.0	95.0
184.99	95.2	95.2	95.2	95.2	95.2	95.2	95.2	95.3	95.2
189.99	95.5	95.5	95.5	95.5	95.5	95.5	95.5	95.5	95.5
194.99	95.7	95.7	95.7	95.7	95.7	95.7	95.7	95.7	95.7
199.99	96.0	96.0	95.9	96.0	95.9	96.0	95.9	96.0	96.0

APPENDIX B

Cube Interferograms

The interferograms taken by Itek for use in determination of the dihedral angles and the far field patterns of the six initial cube corner retroreflectors are shown in Figures B1 - B6. The interferograms taken by ZYGO of the three reworked cubes for use in the Itek analysis are shown in Figures B7 - B9.

FIGURE B1

INTERFEROGRAMS OF CUBE NUMBER 1

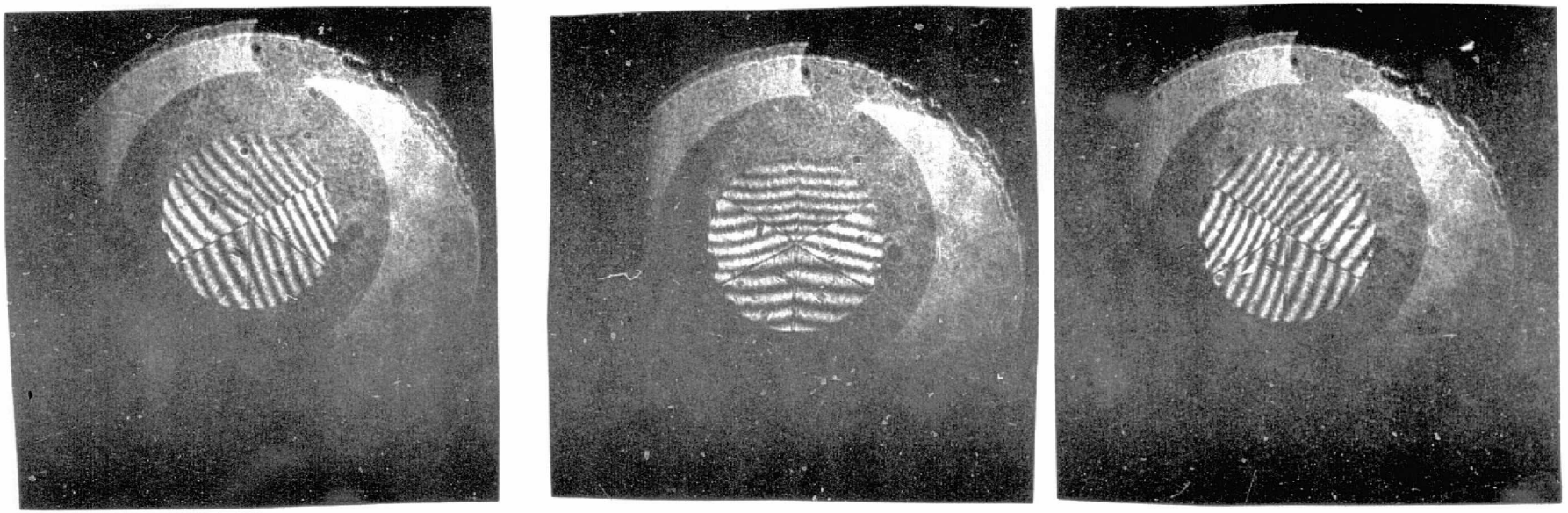


FIGURE B2

INTERFEROGRAMS OF CUBE NUMBER 2

FIGURE B3

INTERFEROGRAMS OF CUBE NUMBER 3

FIGURE B4

INTERFEROGRAMS OF CUBE NUMBER 4

FIGURE B5

INTERFEROGRAMS OF CUBE NUMBER 5

FIGURE B6

INTERFEROGRAMS OF CUBE NUMBER 6

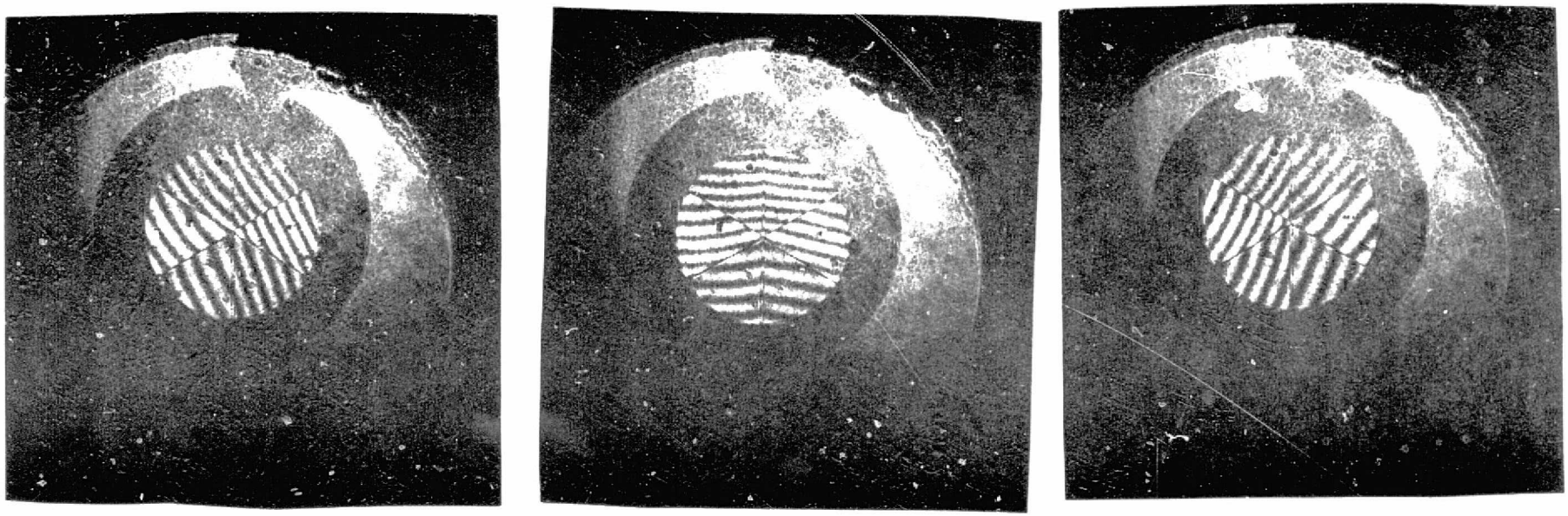


FIGURE B7

ZYGO INTERFEROGRAMS OF CUBE NUMBER 1RW

FIGURE B8

ZYGO INTERFEROGRAMS OF CUBE NUMBER 2RW

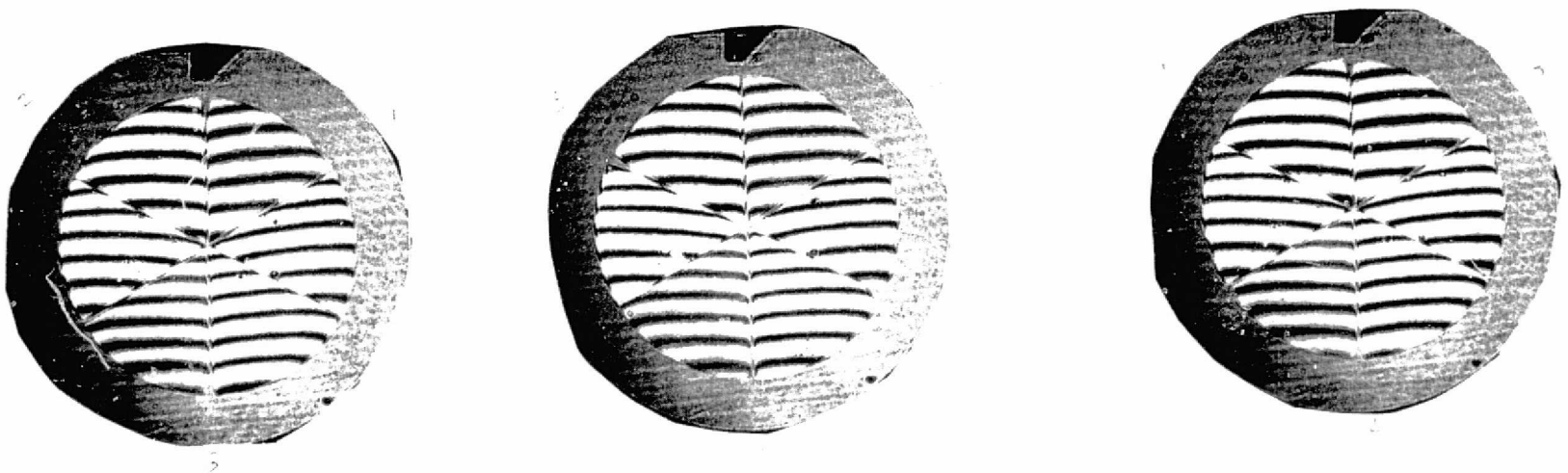


FIGURE B9

ZYGO INTERFEROGRAMS OF CUBE NUMBER 3RW

APPENDIX C

Dihedral Angle Calculations

When a ray is incident on the front face of a perfect retroreflector (90° cube corner) it is consecutively reflected by the three reflecting surfaces and leaves the reflector in a direction parallel to the incoming ray at a point diametrically opposite to its point of entry. When the angles are not perfect 90° angles the ray will be deviated and will not exit parallel to the incoming ray. This study is intended to obtain the deviation of the angles of the cube corner from a 90° corner by examining the wavefront exiting the cube.

In figure C.1 δmn is defined as the angular deviation of surface m at a point adjacent to surface number n due to a rotation of surface m about the axis perpendicular to surface n. As an example δ_{12} is the angular deviation of surface number 1 at a point adjacent to surface number 2 due to a rotation of surface 1 about the x axis. The deviations of the angles of the cube from a perfect 90° are referred to as the dihedral angles and are determined by

$$\alpha_{12} = \delta_{13} + \delta_{23} \qquad C\ 1$$

$$\alpha_{23} = \delta_{31} + \delta_{21} \qquad C\ 2$$

$$\alpha_{13} = \delta_{12} + \delta_{32} \qquad C\ 3$$

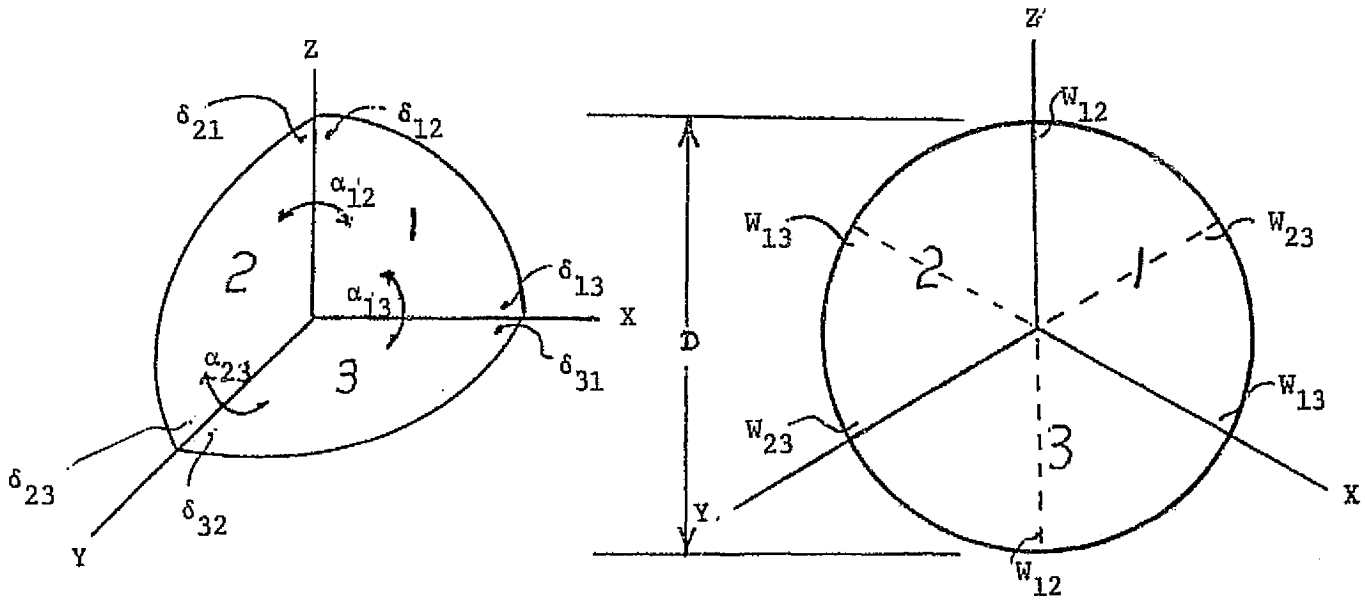


Figure C-1
Cube Coordinate System

In general, the optical path difference (OPD) introduced by a small perturbation to a reflecting surface is given by[1]

$$OPD = 2N\ S\ \text{Cos}\ \theta$$

where N is the index of refraction of the material, S is the deviation of the surface from nominal measured normal to the surface, and θ is the angle of incidence of the ray at the surface. For the axial beam, the angle of incidence at each surface is the same and has the value defined by $\text{Cos}\ \theta = 1/\sqrt{3}$.[2]

Referring to figure C-1, it can be seen that the surface deviation at any point on a surface is equal to the angular deviation multiplied by the distance of that point from the center of the cube. For example, in calculating W_{12}, the ray strikes surfaces 1 and 2 at the real edge and surface 3 at the center of the surface. The distance from the center along the real edge is $D/(2\ \text{Sin}\ \theta)$ and the distance from the center to the ray on surface 3 is $D/(2\ \text{Cos}\ \theta)$. Thus,

$$W_{12} = 2\left(\frac{D}{2\ \text{Cos}\ \theta}\left(\frac{\delta_{31} + \delta_{32}}{\sqrt{2}}\right) + \frac{D\ \delta_{21}}{2\ \text{Sin}\ \theta} + \frac{D\ \delta_{12}}{2\ \text{Sin}\ \theta}\right) N\ \text{Cos}\ \theta \qquad C5$$

where $\text{Cos}\ \theta = \frac{1}{\sqrt{3}}$

$\text{Sin}\ \theta = \sqrt{\frac{2}{3}}$

$$\therefore\ W_{12} = \frac{ND}{\sqrt{2}}\left(\delta_{31} + \delta_{32} + \delta_{21} + \delta_{12}\right). \qquad C6$$

Using equations C2 and C3.

$$W_{12} = \frac{ND}{\sqrt{2}}\left(\alpha_{23} + \alpha_{13}\right) \qquad C7$$

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1 M.P. Rimmer, App. Opt. 9, 533 (1970)

2 E.R. Peck, J. Opt. Soc Am. 52, 253 (1962)

In the same manner W_{13} and W_{23} is given by

$$W_{13} = \frac{ND}{\sqrt{2}} (\alpha_{12} + \alpha_{23}) \qquad C8$$

$$W_{23} = \frac{ND}{\sqrt{2}} (\alpha_{12} + \alpha_{13}) \qquad C9$$

Using equations C6, C7, and C8 the dihedral angles can be solved for

$$\alpha_{13} = \frac{1}{\sqrt{2}\ ND} (W_{12} + W_{23} - W_{13}) \qquad C10$$

$$\alpha_{23} = \frac{1}{\sqrt{2}\ ND} (W_{12} + W_{13} - W_{23}) \qquad C11$$

$$\alpha_{12} = \frac{1}{\sqrt{2}\ ND} (W_{13} + W_{23} - W_{12}). \qquad C12$$

Another useful quantity is the angle between the exiting rays and the incoming rays. This can be determined from the values of W_{12}, W_{13}, and W_{23} using the fact that the rays are normal to the wavefront in each sextant. The result for the sextant between W_{12} and W_{23} is

$$\text{Sin } \emptyset = \frac{4}{\sqrt{3}\ D} \sqrt{W_{12}^{\ 2} + W_{23}^{\ 2} - W_{12} W_{23}} \qquad C13$$

where $\emptyset$ is the angle between the entering rays and exiting rays. The angle between rays exiting from two opposite sextants is 2 $\emptyset$. Similar results are obtained for the other sextants. Equation C13 can be written in terms of the dihedral angles by substituting equations C7 - C9. When all of the dihedral angles are equal, it can be seen that

$$\text{Sin } \emptyset = 4N\sqrt{\frac{2}{3}}\ \alpha \qquad C14$$

where α is the dihedral angle error. This result is in agreement with Yoder.[3]

[3] P.R. Yoder, Jr. J. Opt. Soc. Am. 48, 496 (1958)

APPENDIX D

Viewgraph Presentation

Copies of the viewgraphs presented at a briefing at George C. Marshall Space Flight Center, Huntsville, Alabama on 24 October, 1974 are given on pages D2 - D29. Copies of the viewgraphs presented at a briefing at NASA/MSFC on 18 December are given on pages D30 - D52.

LAGEOS

DIHEDRAL ANGLE IMPROVEMENT PROGRAM

PREPARED UNDER

CONTRACT TO

BENDIX AEROSPACE SYSTEMS DIVISION

24 OCTOBER 1974

Itek

TOPICS

- PURPOSE/OBJECTIVES
- TASKS
- SUMMARY OF RESULTS
- INTERFEROMETRY OF CUBES
- PREDICTION OF DIHEDRAL ANGLES
- PREDICTION OF FAR FIELD PATTERN
- TOLERANCE ANALYSIS
- CONCLUSIONS

PURPOSE/OBJECTIVES

RESOLVE CONTRADICTIONS IN TEST RESULTS

- PREDICT DIHEDRAL ANGLES FROM INTERFEROGRAMS
  COMPARE WITH INDEPENDENT MEASUREMENTS
- PREDICT FAR FIELD PATTERN FROM INTERFEROGRAMS
  COMPARE WITH MEASURED DATA
- RECOMMEND REVISED DIHEDRAL ANGLE
- ANALYZE REWORKED CUBES

TASKS

- EVALUATE EXISTING CUBES
  - ANALYZE ZYGO INTERFEROGRAMS
    - PREDICT DIHEDRAL ANGLES
  - TEST CUBES IN TWYMAN-GREEN INTERFEROMETER
  - ANALYZE ITEK INTERFEROGRAMS
    - PREDICT DIHEDRAL ANGLES
    - PREDICT FAR FIELD PATTERN
- TOLERANCE ANALYSIS (.9 - 2.1 ARC-SEC)
- MODEL COMPARISON (SAO)
- EVALUATE REWORKED CUBES
  - ANALYZE ZYGO INTERFEROGRAMS
    - PREDICT DIHEDRAL ANGLES
    - PREDICT FAR FIELD PATTERN

SUMMARY - DIHEDRAL ANGLE

		AVERAGE DIHEDRAL ANGLE (ARC-SEC)
***	ITEK INTERFEROGRAMS	1.77
***	ZYGO INTERFEROGRAMS	1.86
*	ITEK FFDP	1.98
**	BENDIX FFDP	2.14

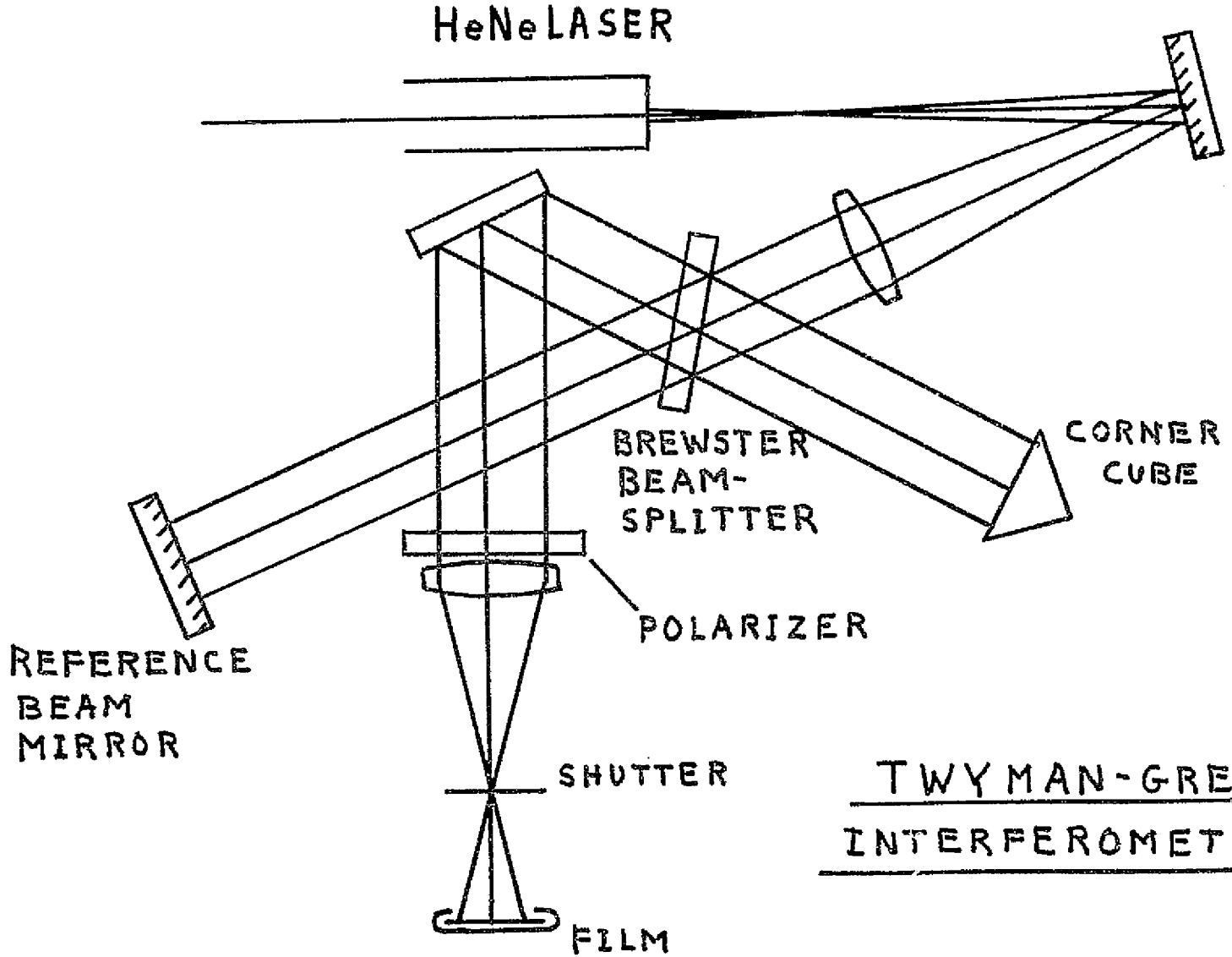
*Based on far field pattern predicted from interferograms.
**Based on far field pattern photograph measurement.
***Analyzed by Itek.

SUMMARY - FAR FIELD DIFFRACTION PATTERN

	AVERAGE PERCENT ENERGY IN 13.2 - 16.9 ARC-SEC ANNULUS	AVERAGE ANNULUS DIAMETER (ARC-SEC)
ITEK INTERFEROGRAM	14.3	18.0
BENDIX MEASUREMENT	9.7	20.3

SUMMARY - TOLERANCE STUDY

- PERCENT ENERGY IN 13.2 - 16.9 ARC-SEC ANNULUS VARIES FROM 13.0 TO 18.5 FOR DIHEDRAL ANGLES OF .9-2.1 ARC-SEC
- PEAK PERCENT ENERGY OCCURS AT ABOUT 1.35 ARC-SEC DIHEDRAL ANGLE.
- ANNULUS DIAMETER VARIES FROM 12.4 TO 22.0 ARC-SEC FOR DIHEDRAL ANGLES OF .9 - 2.1 ARC-SEC.
- OFF-NOMINAL CUBE (.0, +.5, -.5 ARC-SEC ERRORS) INCREASES ANNULUS DIAMETER BY UP TO 1.0 ARC-SEC AND CHANGES PERCENT ENERGY BY UP TO 0.7.



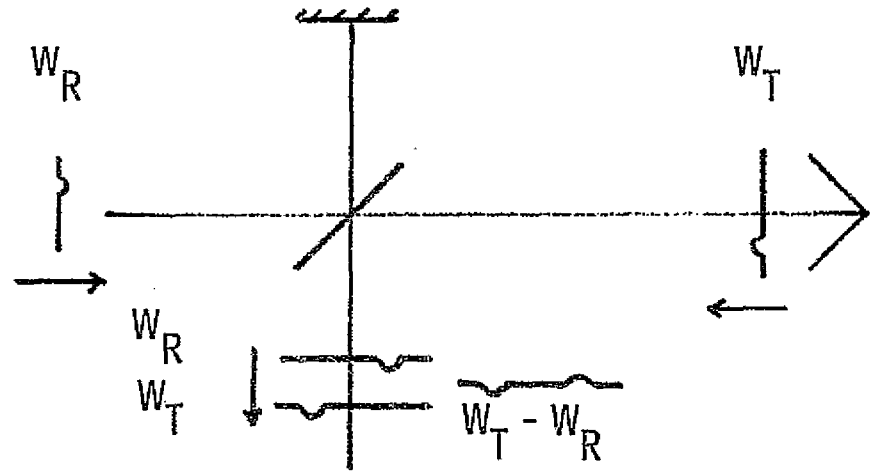
TWYMAN-GREEN INTERFEROMETER

TEST PROCEDURE

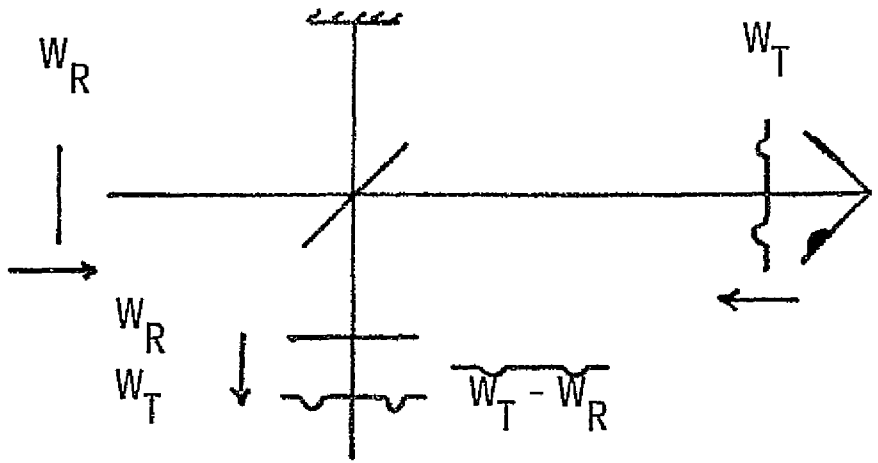
1. CLEAN AND MOUNT CORNER CUBE.
2. TILT CORNER CUBE ~1 DEGREE TO AVOID GLINT.
3. ORIENT POLARIZER.
4. WAIT 20 MINUTES AFTER LAST HANDLING.
5. ORIENT FRINGES PERPENDICULAR TO EACH REAL EDGE.
6. PHOTOGRAPH INTERFEROGRAM.
7. DATA REDUCTION.

INTERFEROGRAMS OF RETROREFLECTOR #3

INTERFEROMETRY OF RETROREFLECTORS



INTERFEROMETER ERROR
RADIALLY ANTI-SYMMETRIC



RETROREFLECTOR ERROR
RADIALLY SYMMETRIC

ANALYSIS OF RETROREFLECTOR INTERFEROGRAMS

MEASURED WAVEFRONT: $W(x, y)$

RETROREFLECTOR ERROR: $1/2 \left[W(x, y) + W(-x, -y) \right]$

INTERFEROMETER ERROR: $1/2 \left[W(x, y) - W(-x, -y) \right]$

ANALYSIS OF RETROREFLECTOR INTERFEROGRAMS (CONTINUED)

FAR FIELD PATTERN

MEASURED PHASE IS FOR COMPONENT PARALLEL TO INPUT.

USE THEORETICAL INTENSITY VARIATIONS.

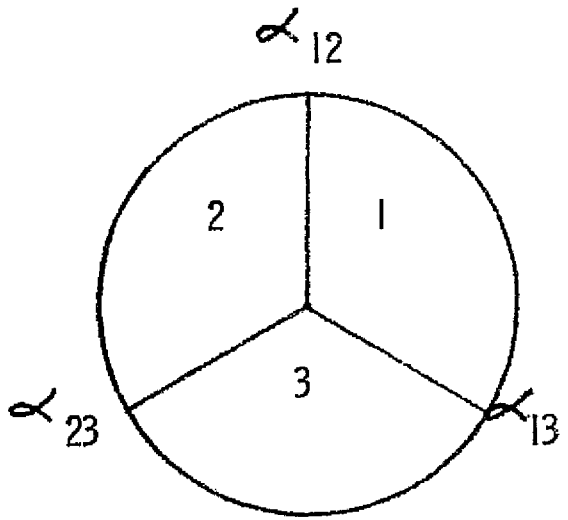
ADD THEORETICAL PHASE SHIFTS FOR PERPENDICULAR COMPONENT.

DIHEDRAL ANGLE

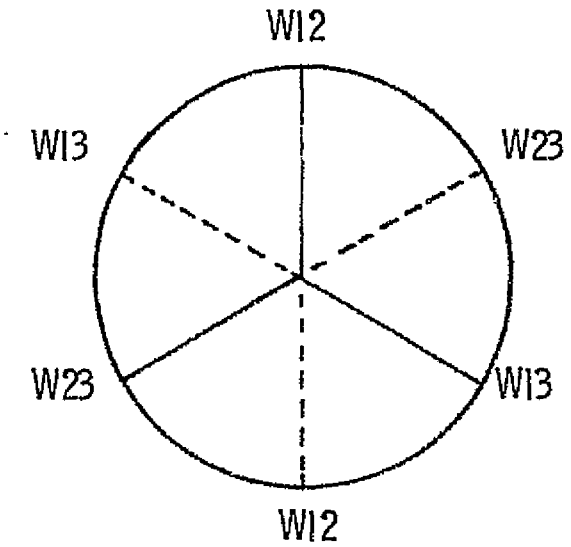
FIT PLANE THROUGH EACH SEXTANT TO GET AVERAGE SLOPE.

CALCULATE DIHEDRAL ANGLES.

CALCULATION OF DIHEDRAL ANGLES FROM INTERFEROGRAM



Cube



Wavefront

$$\alpha_{12} = \sqrt{\frac{1}{2\,nD}} \left[W_{13} + W_{23} - W_{12}\right]$$

$$\alpha_{13} = \sqrt{\frac{1}{2\,nD}} \left[W_{23} + W_{12} - W_{13}\right]$$

$$\alpha_{23} = \sqrt{\frac{1}{2\,nD}} \left[W_{12} + W_{13} - W_{23}\right]$$

n = index
D = diameter

INTERFEROMETRIC MEASUREMENT OF DIHEDRAL ANGLES (arc-sec)

Cube	Interferogram 1			2			3			Average			Ave
1	1.38	1.71	1.87	1.53	1.68	2.01	1.63	1.90	1.98	1.51	1.76	1.95	1.74
2	1.62	2.19	2.03	1.64	1.91	1.82	1.77	2.00	2.08	1.68	2.03	1.98	1.90
3	1.32	1.30	1.61	1.30	1.38	1.59	1.38	1.53	1.53	1.33	1.40	1.58	1.44
4	1.83	1.67	1.87	1.86	1.87	1.76	1.86	1.72	1.92	1.85	1.75	1.85	1.82
5	2.24	2.38	2.01	2.23	2.28	1.94	2.19	2.10	1.88	2.22	2.25	1.94	2.14
6	1.76	1.64	1.51	1.50	1.68	1.59	1.56	1.44	1.65	1.61	1.59	1.58	1.59
											Average		1.77

(1σ = .07 Arc-Sec)

COMPARISON OF DIHEDRAL ANGLES ON CUBES 1, 2, AND 4

Cube	*Itek Interferograms			*Zygo Interferograms			Moore Mechanical Measurements		
1	1.51	1.76	1.95	2.44	1.84	2.04	2.14	2.00	1.72
2	1.68	2.03	1.98	1.98	1.76	0.98	1.68	1.84	1.76
4	1.85	1.75	1.85	2.02	1.31	1.65	1.82	1.80	1.80
Average	1.82			1.78			1.84		

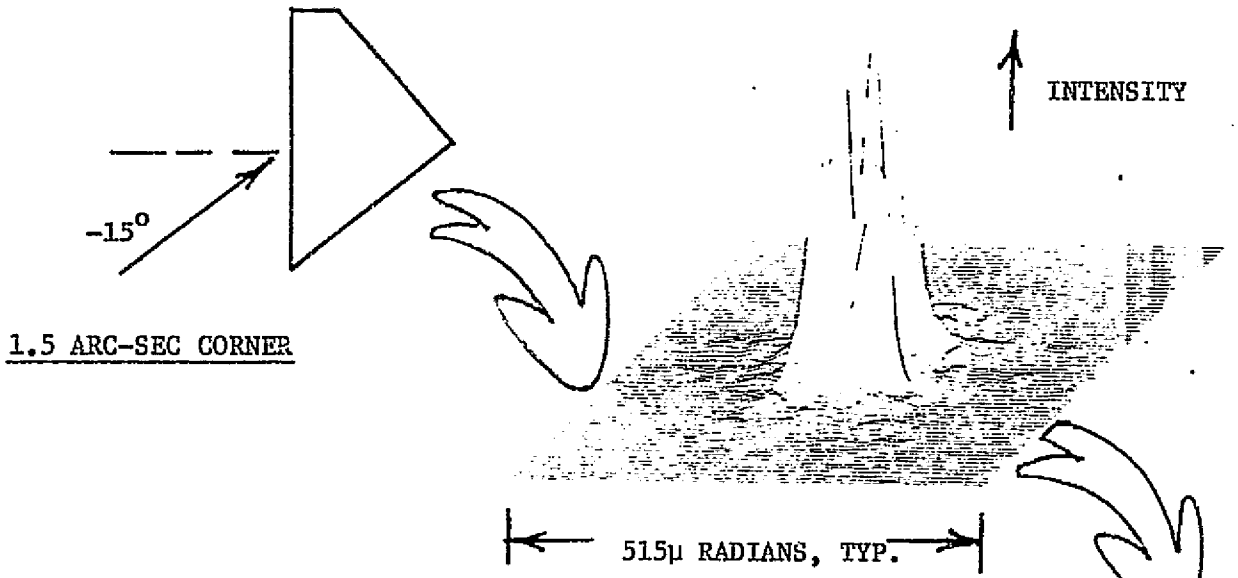
*Analyzed by Itek.

COMPARISON OF AVERAGE DIHEDRAL ANGLE (arc-sec)

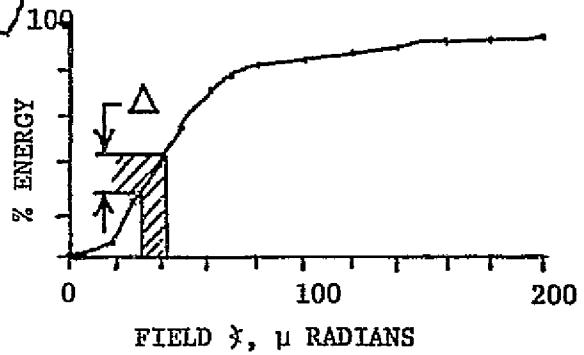
Cube	*** Itek Interferogram	*** Zygo Interferogram	*Itek FFDP	**Bendix FFDP
1	1.74	2.11	1.96	2.32
2	1.90	1.57	2.13	2.08
3	1.44	1.78	1.74	1.85
4	1.82	1.66	1.96	2.17
5	2.14	2.31	2.30	2.48
6	1.59	1.71	1.78	1.94
Average	1.77	1.86	1.98	2.14

*Based on far field pattern predicted from interferograms.
**Based on far field pattern photograph measurement.
***Analyzed by Itek.

FAR-FIELD CHARACTERISTICS



FAR FIELD DIFFRACTION PATTERN

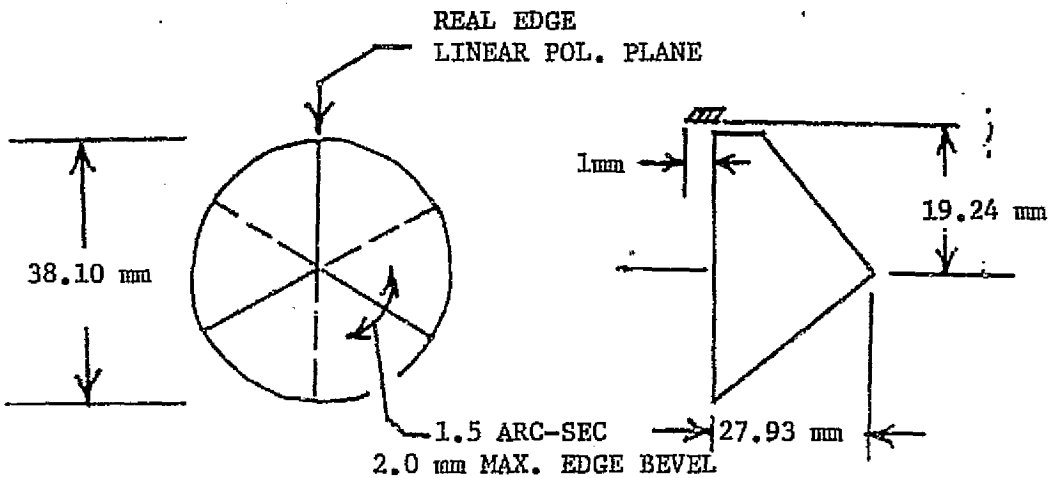


ENCIRCLED ENERGY

ASSUMPTIONS/INPUTS

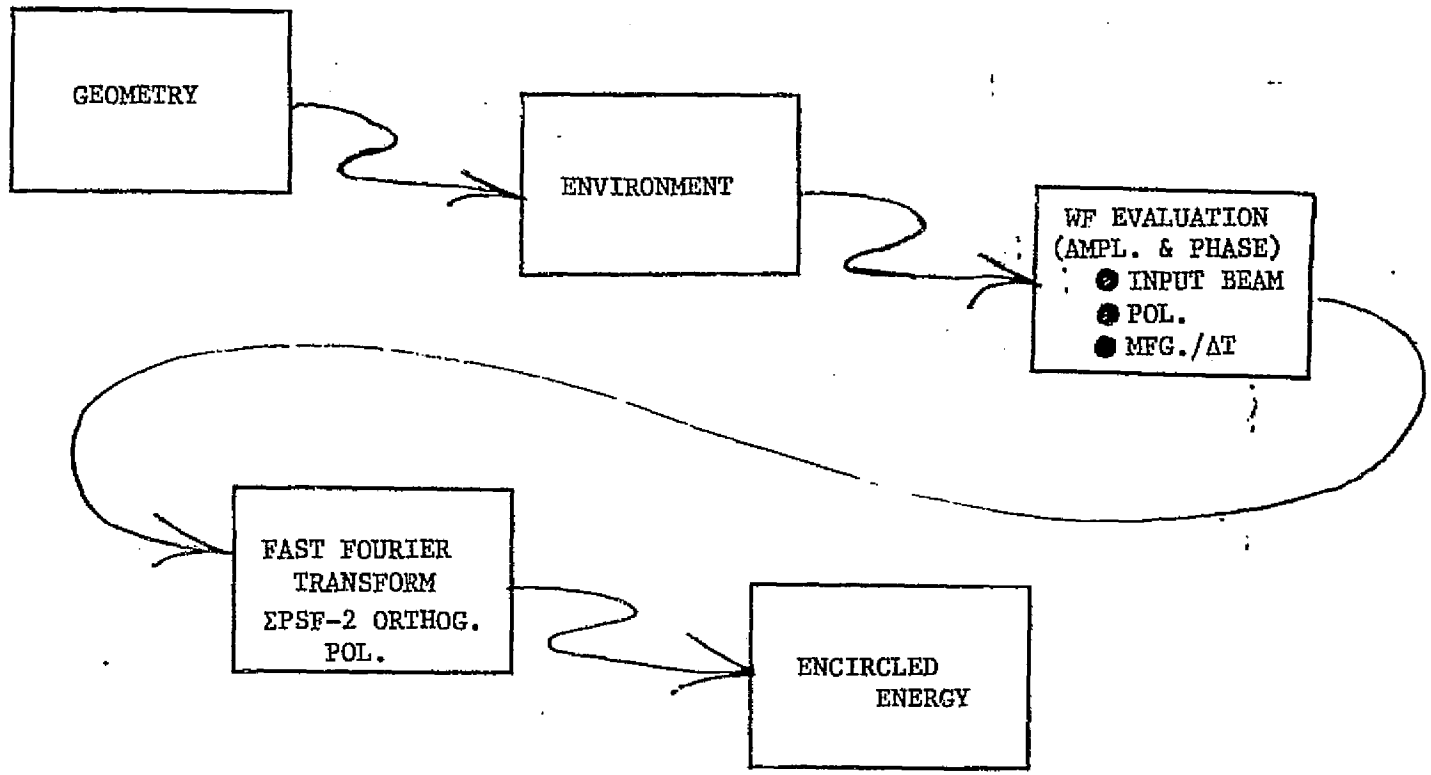
- MATERIAL
  - T-19 SUPRASIL 1 (SPECIAL)
  - AMERSIL DATA - $N(\lambda)$, $\partial n/\partial T$ $(\lambda, T, P) \rightarrow 7$ to 8.5 x $10^{-6}/^{o}C$
  - HOMOSIL, CONSERVATIVE

- GEOMETRY



- LASER
  - 6328Å, FLAT WF, CENTERED
  - 20% GAUSSIAN VARIATION OVER 50 mm DIAMETER

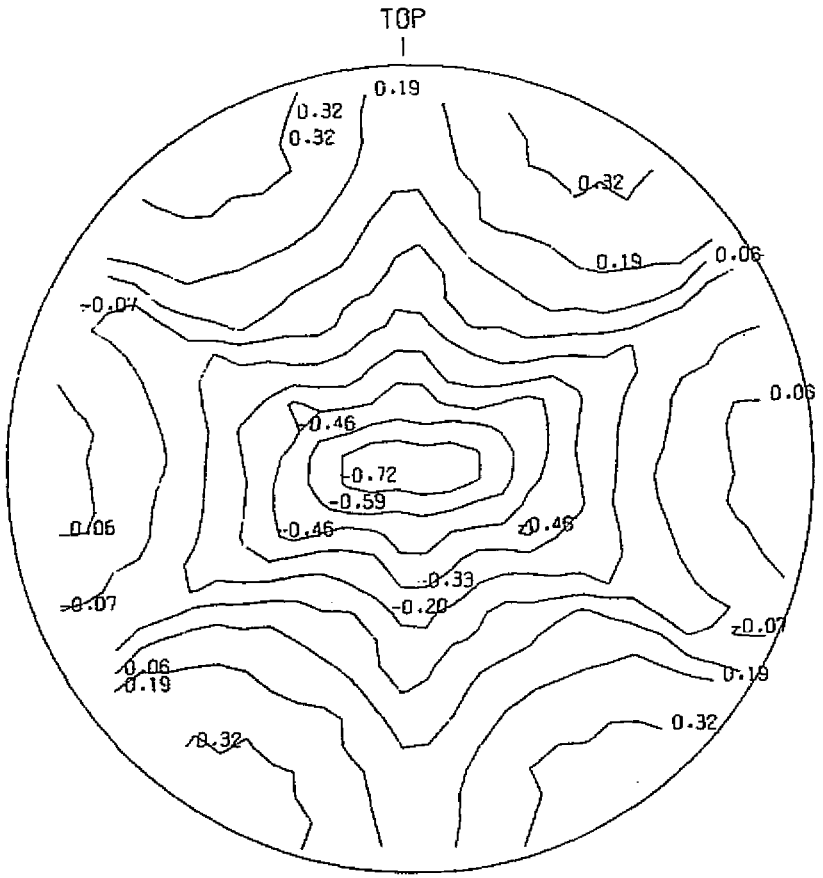
TECHNIQUES/MODEL



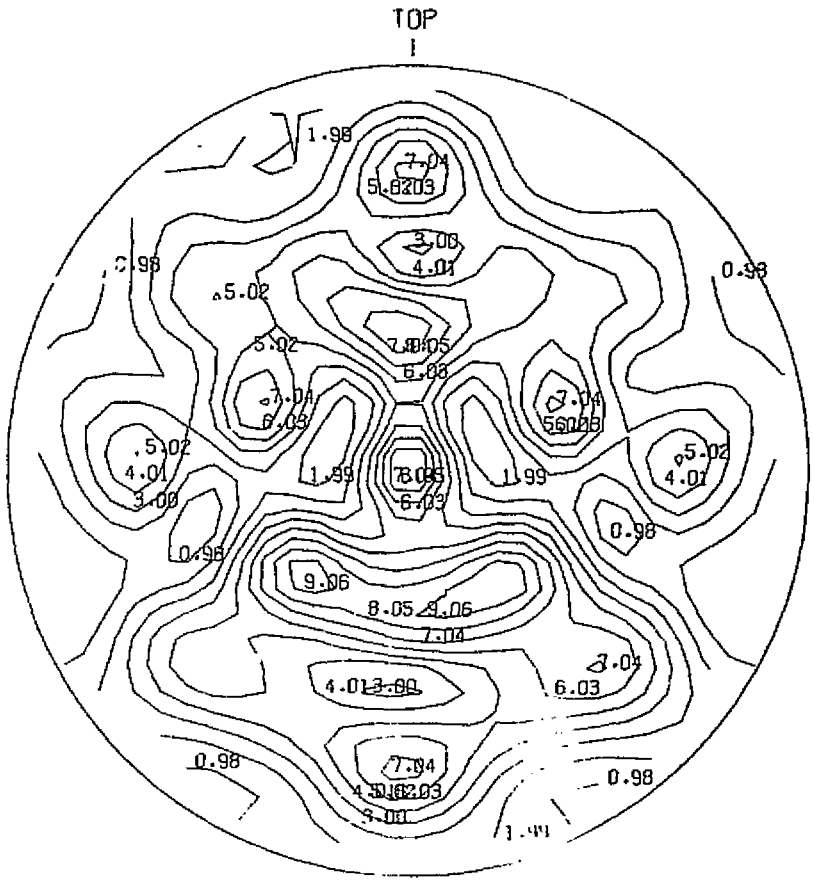
ACCURACY ~ 1% IN ENCIRCLED ENERGY

WAVEFRONT AND FAR FIELD DIFFRACTION PATTERNS FROM RETROREFLECTOR #3*

Wavefront Plot
Q Polarization

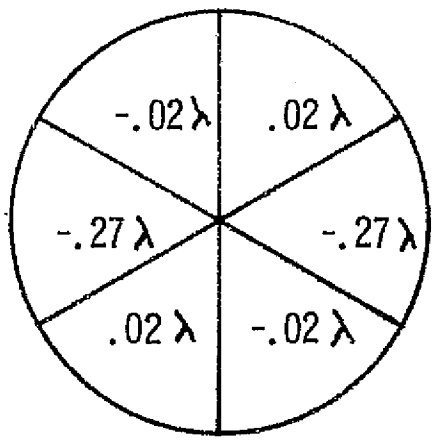


Intensity Distribution
Central 129 Microradians



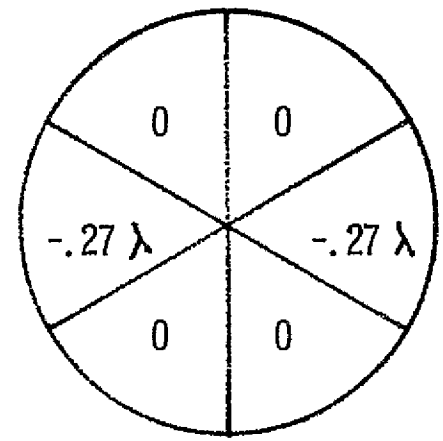
*Data is obtained from an average of three interferograms.

PHASE SHIFT DUE TO POLARIZATION



INTERFEROMETRIC
MEASUREMENT

(1σ = .02λ)



THEORETICAL

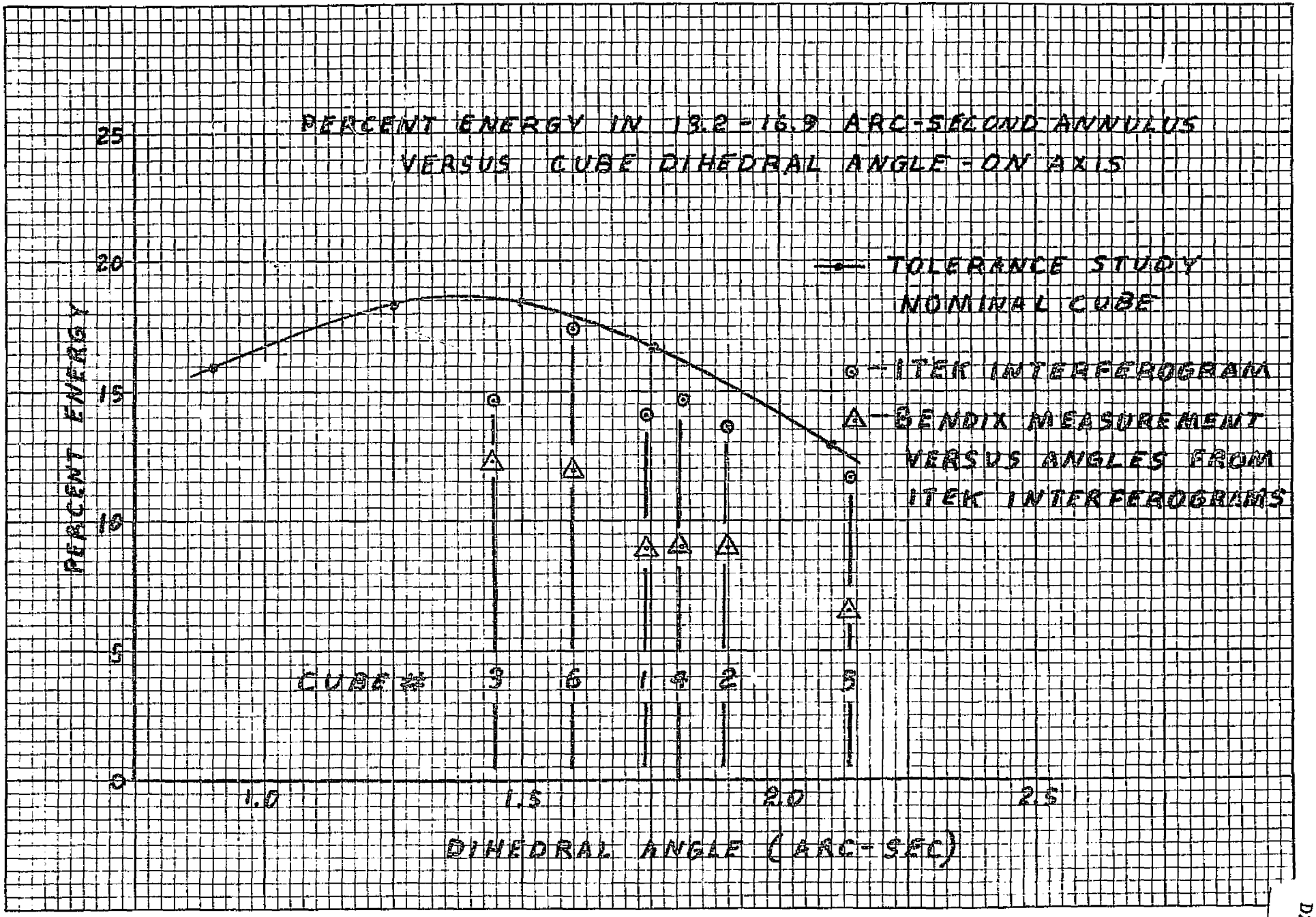
FAR FIELD CHARACTERISTICS OF LAGEOS RETROREFLECTOR - ON-AXIS

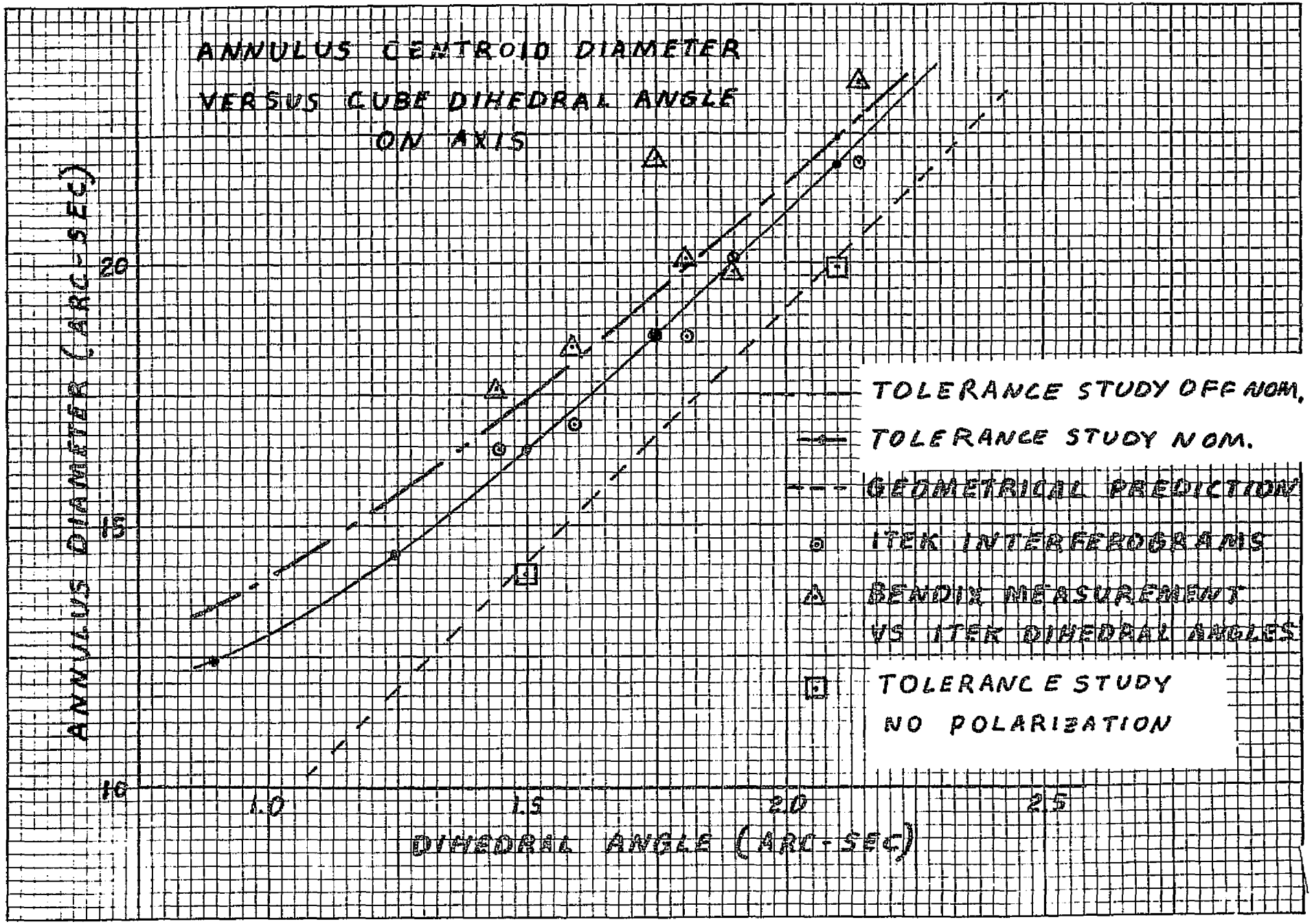
Cube #	Percent Energy 13.2 - 16.9 Arc-Sec		Annulus Diameter (Arc-Sec)	
	Itek Interferogram	Bendix Measurement	Itek Interferogram	Bendix Measurement
1	14.0	8.9	18.6	22.0
2	13.6	8.9	20.2	19.8
3	14.7	12.4	14.4	17.6
4	14.6	9.0	18.6	20.6
5	11.7	6.7	21.9	23.5
6	17.4	12.0	14.4	18.4
Average	14.3	9.7	18.0	20.3

TOLERANCE STUDY
Encircled Energy & Apparent Annulus Diameter
On-Axis

Case	Percent Energy 13.2 - 16.9 Arc-Sec	Apparent Annulus Diameter (Arc-Sec)
0.9 Arc-Sec Nominal Cube	16.0	12.4
* 0.9 Arc-Sec Off Nominal Cube	16.7	13.4
1.25 Arc-Sec Nominal Cube	18.3	14.4
1.5 Arc-Sec Nominal Cube	18.5	16.5
* 1.5 Arc-Sec Off Nominal Cube	18.2	17.3
1.75 Arc-Sec Nominal Cube	16.8	18.6
2.1 Arc-Sec Nominal Cube	13.0	22.0
* 2.1 Arc-Sec Off Nominal Cube	12.3	22.4

*.0, +.5, -.5 Arc-Sec Errors





SUMMARY

- AVERAGE DIHEDRAL ANGLE IS 1.8 ARC-SEC.
- AVERAGE FAR FIELD ANNULUS DIAMETER IS 18.0 ARC-SEC.
- PEAK ENERGY IN 13.2 - 16.9 ARC-SEC ANNULUS OCCURS FOR A 1.35 ARC-SEC CUBE.
- .0, +.5, -.5 ARC-SEC ERRORS INCREASE ANNULUS DIAMETER SLIGHTLY.
- MEASURED FFDP SHOWS CONSISTENTLY HIGH ANNULUS DIAMETER AND LOW PERCENT ENERGY IN 13.2 - 16.9 ARC-SEC ANNULUS.

PRELIMINARY CONCLUSIONS/RECOMMENDATIONS

- FAR FIELD ANNULUS IS LARGER THAN GEOMETRICAL PREDICTION DUE TO DIFFRACTION/POLARIZATION.
- NOMINAL DIHEDRAL ANGLES SHOULD BE REDUCED TO 1.25 ARC-SEC.
- ANALYZE AND TEST REWORKED CUBES AS PLANNED.
- CONSIDER ANALYSIS FOR OTHER INCIDENT ANGLES AND WAVE-LENGTHS.

LAGEOS

DIHEDRAL ANGLE IMPROVEMENT PROGRAM

PREPARED UNDER

CONTRACT TO

BENDIX AEROSPACE SYSTEMS DIVISION

18 DECEMBER 1974

Itek

PURPOSE/OBJECTIVES

RESOLVE CONTRADICTIONS IN TEST RESULTS

- PREDICT DIHEDRAL ANGLES FROM INTERFEROGRAMS
  COMPARE WITH INDEPENDENT MEASUREMENTS
- PREDICT FAR FIELD PATTERN FROM INTERFEROGRAMS
  COMPARE WITH MEASURED DATA
- MAKE DECISION ON REVISED DIHEDRAL ANGLE
- ANALYZE REWORKED CUBES

TASKS

- EVALUATE EXISTING CUBES
  - ANALYZE ZYGO INTERFEROGRAMS
    - PREDICT DIHEDRAL ANGLES
  - TEST CUBES IN TWYMAN-GREEN INTERFEROMETER
  - ANALYZE ITEK INTERFEROGRAMS
    - PREDICT DIHEDRAL ANGLES
    - PREDICT FAR FIELD PATTERN
- TOLERANCE ANALYSIS (.9 - 2.1 ARC-SEC)
- MODEL COMPARISON (SAO)
- EVALUATE REWORKED CUBES
  - ANALYZE ZYGO INTERFEROGRAMS
    - PREDICT DIHEDRAL ANGLES
    - PREDICT FAR FIELD PATTERN

SUMMARY - DIHEDRAL ANGLE

		AVERAGE DIHEDRAL ANGLE (ARC-SEC)
***	ITEK INTERFEROGRAMS	1.77
***	ZYGO INTERFEROGRAMS	1.86
*	ITEK FFDP	1.98
**	BENDIX FFDP	2.14

*Based on far field pattern predicted from interferograms.
**Based on far field pattern photograph measurement.
***Analyzed by Itek.

SUMMARY - FAR FIELD DIFFRACTION PATTERN

	AVERAGE PERCENT ENERGY IN 13.2 - 16.9 ARC-SEC ANNULUS	AVERAGE CENTROID DIAMETER (ARC-SEC)
ITEK INTERFEROGRAM	14.3	18.7
BENDIX MEASUREMENT	9.7	20.3

SUMMARY - TOLERANCE STUDY

- PERCENT ENERGY IN 13.2 - 16.9 ARC-SEC ANNULUS VARIES FROM 13.0 TO 18.5 FOR DIHEDRAL ANGLES OF .9-2.1 ARC-SEC
- PEAK PERCENT ENERGY OCCURS AT ABOUT 1.35 ARC-SEC DIHEDRAL ANGLE.
- CENTROID DIAMETER VARIES FROM 12.4 TO 22.0 ARC-SEC FOR DIHEDRAL ANGLES OF .9 - 2.1 ARC-SEC.
- OFF-NOMINAL CUBE (.0, +.5, -.5 ARC-SEC ERRORS) INCREASES CENTROID DIAMETER BY UP TO 1.0 ARC-SEC AND CHANGES PERCENT ENERGY BY UP TO 0.7.

COMPARISON OF DIHEDRAL ANGLES ON CUBES 1, 2, AND 4

Cube	*Itek Interferograms			*Zygo Interferograms			Moore Mechanical Measurements		
1	1.51	1.76	1.95	2.44	1.84	2.04	2.14	2.00	1.72
2	1.68	2.03	1.98	1.98	1.76	0.98	1.68	1.84	1.76
4	1.85	1.75	1.85	2.02	1.31	1.65	1.82	1.80	1.80
Average	1.82			1.78			1.84		

*Analyzed by Itek.

COMPARISON OF AVERAGE DIHEDRAL ANGLE (arc-sec)

Cube	*** Itek Interferogram	*** Zygo Interferogram	*Itek FFDP	**Bendix FFDP
1	1.74	2.11	1.96	2.32
2	1.90	1.57	2.13	2.08
3	1.44	1.78	1.74	1.85
4	1.82	1.66	1.96	2.17
5	2.14	2.31	2.30	2.48
6	1.59	1.71	1.78	1.94
Average	1.77	1.86	1.98	2.14

*Based on far field pattern predicted from interferograms.
**Based on far field pattern photograph measurement.
***Analyzed by Itek.

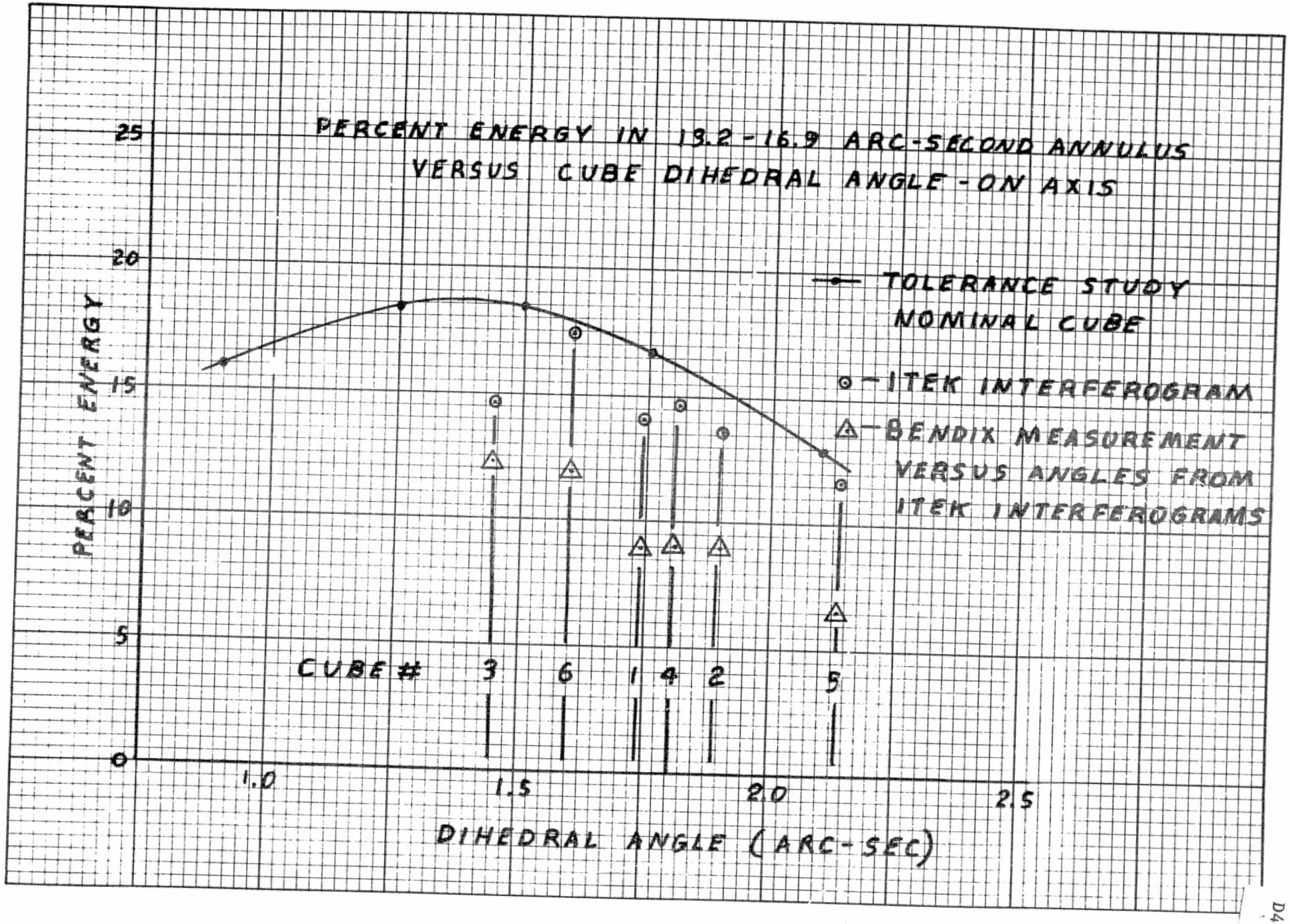
FAR FIELD CHARACTERISTICS OF LAGEOS RETROREFLECTOR - ON-AXIS

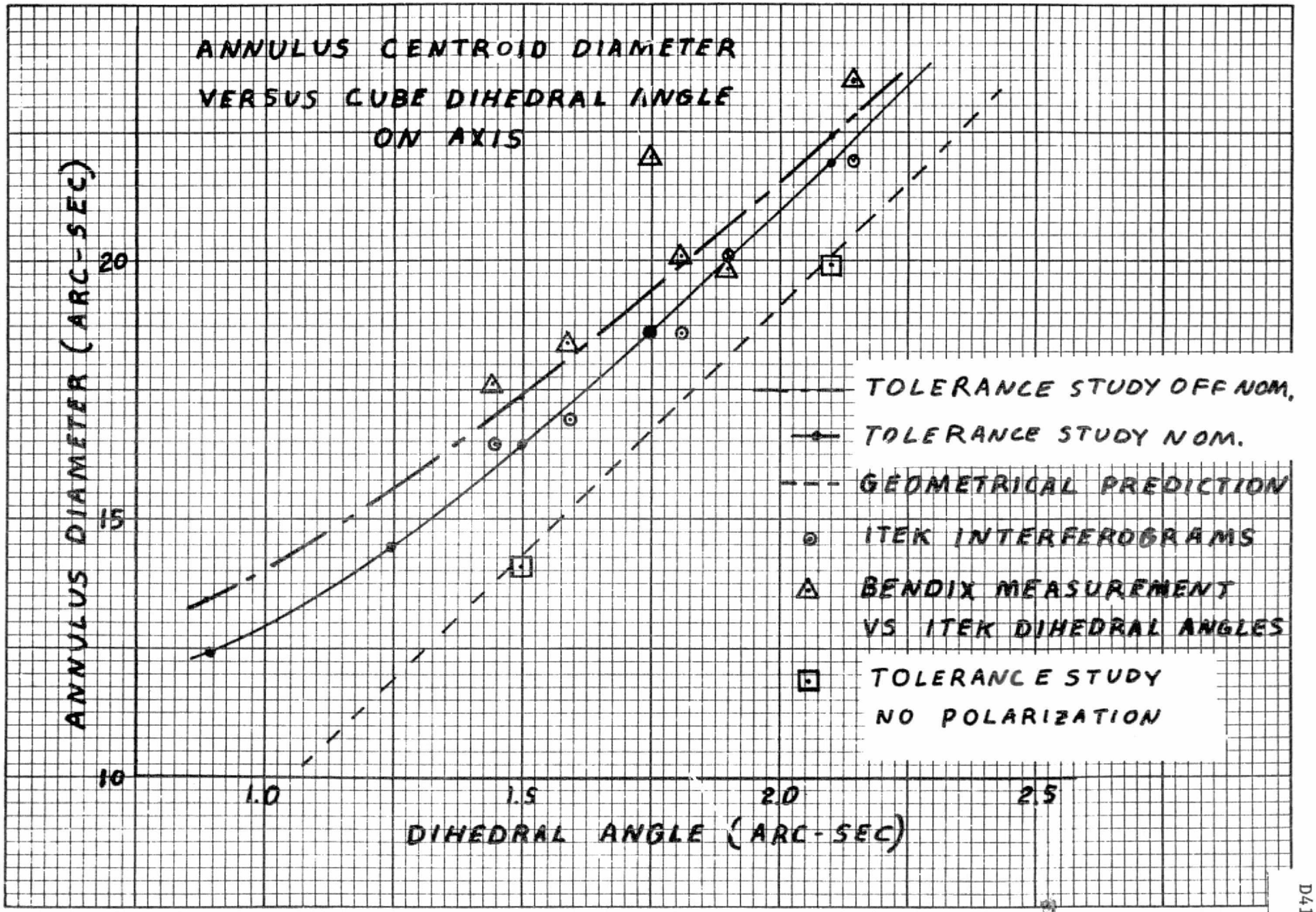
Cube #	Percent Energy 13.2 - 16.9 Arc-Sec Itek Interferogram	Percent Energy 13.2 - 16.9 Arc-Sec Bendix Measurement	Centroid Diameter (Arc-Sec) Itek Interferogram	Centroid Diameter (Arc-Sec) Bendix Measurement
1	14.0	8.9	18.6	22.0
2	13.6	8.9	20.2	19.8
3	14.7	12.4	16.4	17.6
4	14.6	9.0	18.6	20.6
5	11.7	6.7	21.9	23.5
6	17.4	12.0	16.6	18.4
Average	14.3	9.7	18.7	20.3

TOLERANCE STUDY
Encircled Energy & Apparent Centroid Diameter On-Axis

Case	Percent Energy 13.2 - 16.9 Arc-Sec	Apparent Centroid Diameter (Arc-Sec)
0.9 Arc-Sec Nominal Cube	16.0	12.4
* 0.9 Arc-Sec Off Nominal Cube	16.7	13.4
1.25 Arc-Sec Nominal Cube	18.3	14.4
1.5 Arc-Sec Nominal Cube	18.5	16.5
* 1.5 Arc-Sec Off Nominal Cube	18.2	17.3
1.75 Arc-Sec Nominal Cube	16.8	18.6
2.1 Arc-Sec Nominal Cube	13.0	22.0
* 2.1 Arc-Sec Off Nominal Cube	12.3	22.4

*.0, +.5, -.5 Arc-Sec Errors





SUMMARY

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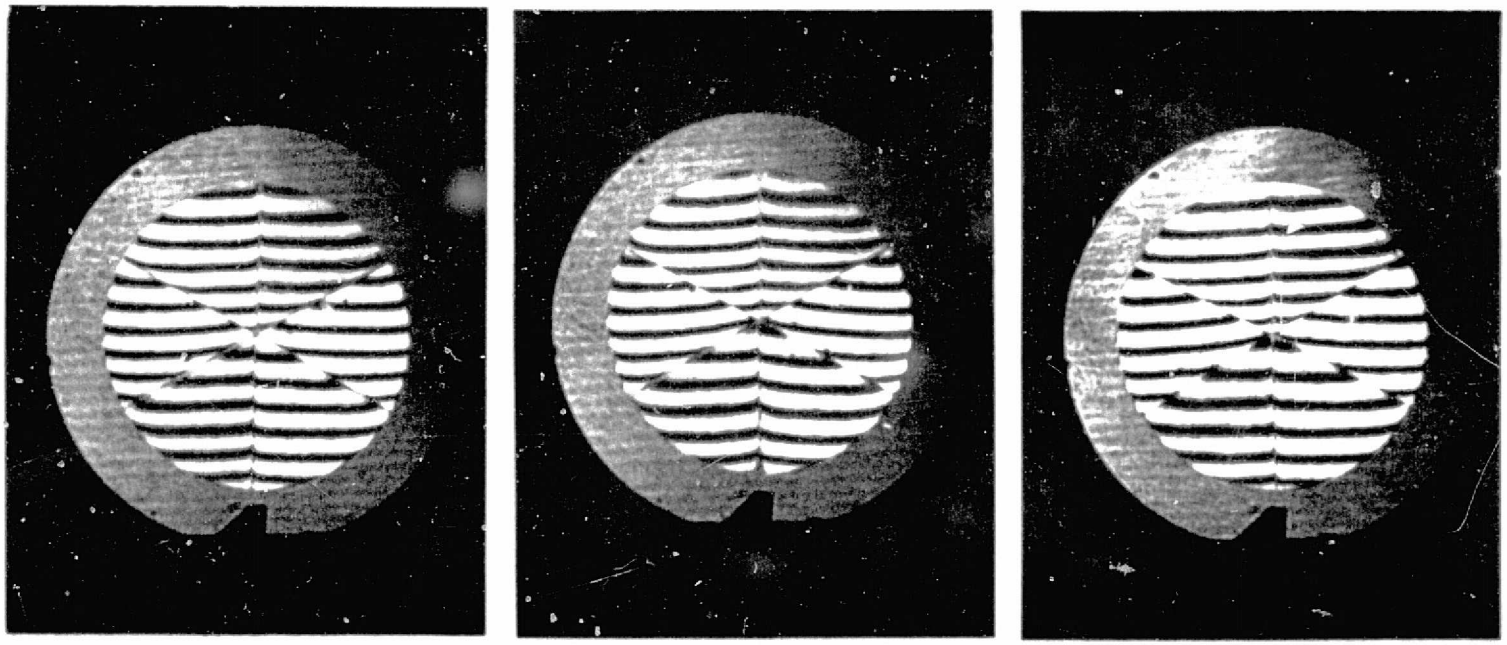
- AVERAGE FAR FIELD CENTROIDDIAMETER IS 18.0 ARC-SEC.
- PEAK ENERGY IN 13.2 - 16.9 ARC-SEC CENTROIDOCCURS FOR A 1.35 ARC-SEC CUBE.
- .0, +.5, -.5 ARC-SEC ERRORS INCREASE ANNULUS DIAMETER SLIGHTLY.
- MEASURED FFDP SHOWS CONSISTENTLY HIGH CENTROID DIAMETER AND LOW PERCENT ENERGY IN 13.2 - 16.9 ARC-SEC ANNULUS.

PRELIMINARY CONCLUSIONS/RECOMMENDATIONS

- INTERFEROMETRIC MEASUREMENT OF DIHEDRAL ANGLES AGREES WITH MECHANICAL MEASUREMENTS ON THE AVERAGE
- PREDICTED FFDP DIFFRACTION PATTERNS AGREE WITH MEASURED PATTERNS CLOSER THAN PREVIOUS PREDICTIONS
- FAR FIELD ANNULUS IS LARGER THAN GEOMETRICAL PREDICTION DUE TO DIFFRACTION/POLARIZATION
- NOMINAL DIHEDRAL ANGLES SHOULD BE REDUCED TO APPROXIMATELY 1.25 ARC-SEC.
- ANALYZE AND TEST REWORKED CUBES AS PLANNED
- CONSIDER ANALYSIS FOR OTHER INCIDENT ANGLES AND WAVE LENGTHS

INTERFEROGRAMS OF REWORKED CUBES



#1 RW

#2 RW

#3 RW

INTERFEROMETRIC MEASUREMENT OF DIHEDRAL ANGLES ON REWORKED CUBES (ARC-SEC)

REWORKED CUBE	INTERFEROGRAM 1	2	3	AVERAGE	AVE.
1	.73 .30 .45	.79 .38 .33	.83 .28 .30	.78 .32 .36	.49
2	.67 .89 .77	.58 .91 .73	.91 .79 .59	.72 .86 .70	.76
3	.28 .17 .40	.24 .30 .16	.25 .26 .30	.26 .24 .29	.26

* BASED ON INTERFEROGRAM PRODUCED BY ZYGO AND ANALYZED BY ITEK

COMPARISON OF DIHEDRAL ANGLES ON REWORKED CUBES (ARC-SEC)

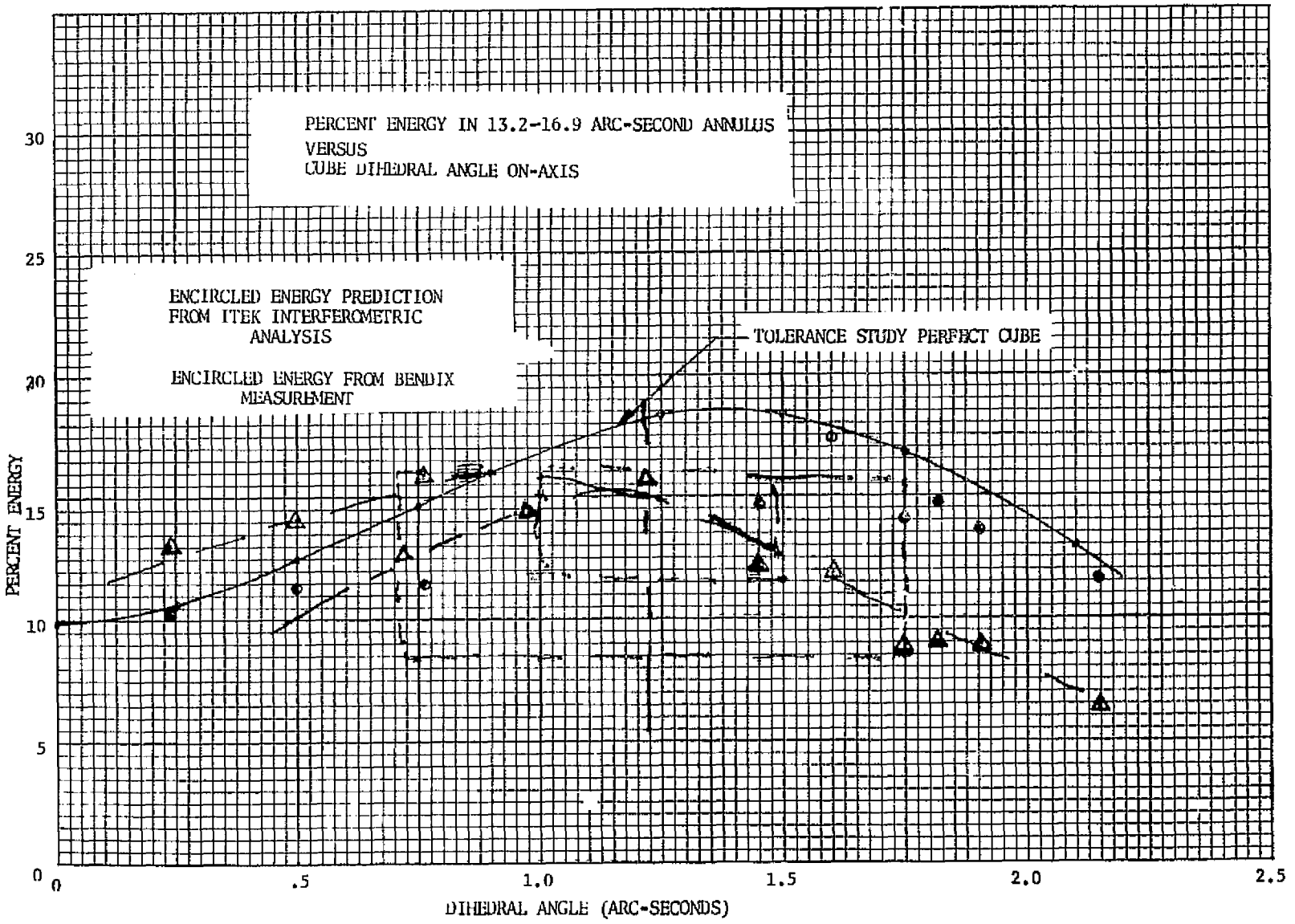
REWORKED CUBE	ITEK INTERFEROGRAM *	AVE.	ZYGO MECHANICAL MEASUREMENT	AVE.	DIFFERENCE
1	0.78 0.32 0.36	0.49	0.97 1.10 0.86	0.98	0.49
2	0.72 0.86 0.70	0.76	1.37 1.26 1.24	1.29	0.53
3	0.26 0.24 0.29	0.26	0.72 0.84 0.82	0.79	0.55

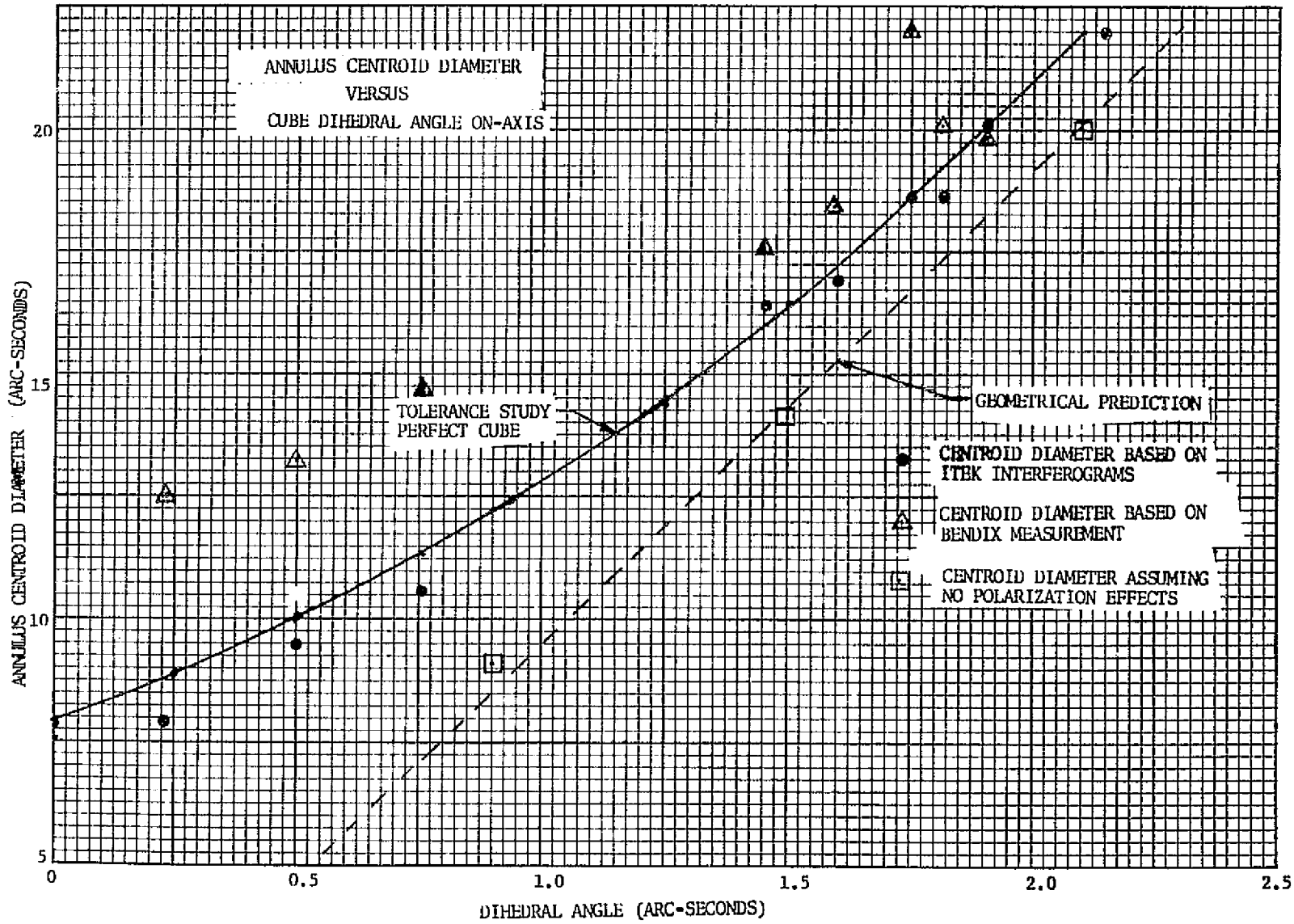
* BASED ON INTERFEROGRAM PRODUCED BY ZYGO AND ANALYZED BY ITEK

FAR FIELD CHARACTERISTICS OF REWORKED CUBES ON AXIS

REWORKED CUBE	PERCENT ENERGY 13.2 - 16.9 ARC SEC		CENTROID DIAMETER (ARC- SEC)	
	ITEK INTERFEROGRAM	BENDIX MEASUREMENT	ITEK INTERFEROGRAM	BENDIX MEASURED
1	11.35	14.0	9.4	13.2
2	11.5	16.0	10.5	14.7
3	10.4	13.0	7.9	12.5

* BASED ON INTERFEROGRAM PRODUCED BY ZYGO AND ANALYZED BY ITEK





MODEL COMPARISON (SAO)

- DISCREPANCIES IN FAR FIELD INTENSITY OF UP TO 10 PERCENT OF PEAK INTENSITY BETWEEN ITEK AND SAO MODEL
- MODIFICATIONS WERE MADE TO ITEK MODEL
- AGREEMENT WITH SAO MODEL OBTAINED
- EFFECT ON RESULTS LESS THAN 0.1% OF TOTAL ENERGY IN 13.2 - 16.9 ARC-SECOND ANNULUS

SUMMARY

- INTERFEROMETRICALLY PREDICTED DIHEDRAL ANGLES ON REWORKED CUBES SMALLER THAN THE DESIRED ANGLES BY ABOUT 0.5 ARC-SECOND
- MECHANICAL MEASUREMENTS OF DIHEDRAL ANGLES ON REWORKED CUBES ARE 0.5 ARC-SECOND LARGER THAN INTERFEROMETRIC PREDICTIONS
- MEASURED FFDP FOR REWORKED CUBES HAS HIGHER PERCENT ENERGY IN ANNULUS THAN INTERFEROMETRIC PREDICTIONS
- INTERFEROMETRICALLY PREDICTED CENTROID DIAMETER FOR REWORKED CUBES IS SMALLER THAN BENDIX MEASUREMENT
- EFFECT OF DISCREPANCIES WITH SAO RESULT IN DEVIATIONS LESS THAN 0.1% IN 13.2-16.9 ARC-SECONDS ANNULUS

CONCLUSIONS/RECOMMENDATIONS

- MEASURED FFDP HAS HIGHER PERCENT ENERGY IN ANNULUS AT LOWER DIHEDRAL ANGLES AND LOWER PERCENT ENERGY AT HIGHER DIHEDRAL ANGLES THAN INTERFEROMETRIC PREDICTIONS
  - DIFFERENCES COULD BE CAUSED BY A REDUCED ANNULUS DIAMETER
- MECHANICALLY MEASURED DIHEDRAL ANGLES FOR THE REWORKED CUBES HAVE A CONSTANT OFFSET FROM THE INTERFEROMETRICALLY PREDICTED DIHEDRAL ANGLES
- BASED ON INTERFEROMETRIC ANALYSIS DIHEDRAL ANGLES SHOULD BE 1.25 ± 0.5 ARC-SECONDS.
- PRODUCTION CUBES SHOULD BE CHECKED INTERFEROMETRICALLY TO VERIFY DIHEDRAL ANGLES.